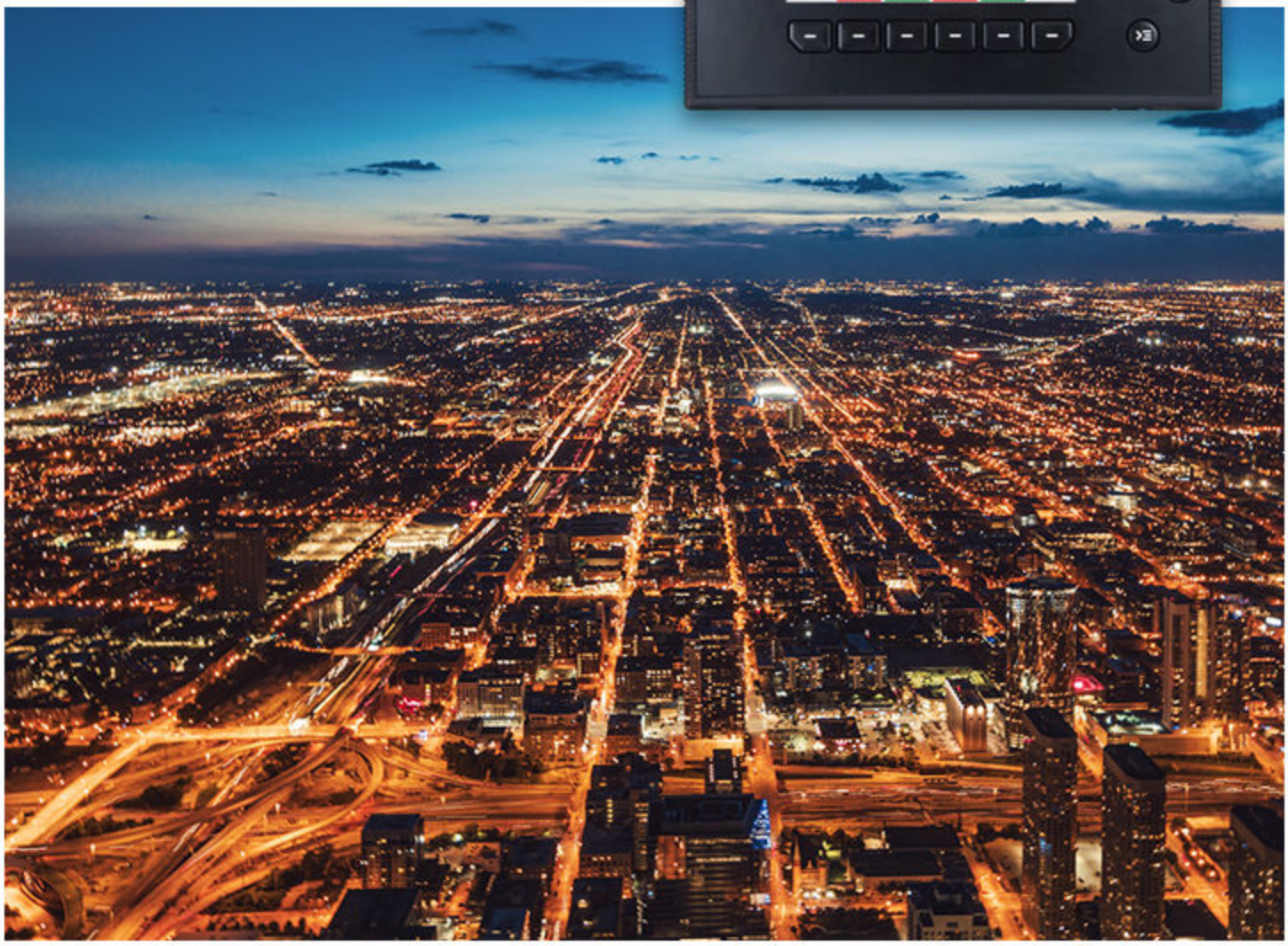
iE 250 PLC

Programmable Automation Controller

Installation instructions

4189341389K

DEIF Improve Tomorrow



1. About the installation instructions

2. Prepare for installation

3. Mount the equipment

4. Wiring the equipment

1. About the installation instructions

1.1 Symbols and notation

Symbols for general notes

NOTE This shows general information.

More information
This shows where you can find more information.

Example

This shows an example.

How to ...
This shows a link to a video for help and guidance.

Symbols for hazard statements

DANGER!

This shows dangerous situations.

If the guidelines are not followed, these situations will result in death, serious personal injury, and equipment damage or destruction.

WARNING

This shows potentially dangerous situations.

If the guidelines are not followed, these situations could result in death, serious personal injury, and equipment damage or destruction.

CAUTION

This shows low level risk situation.

If the guidelines are not followed, these situations could result in minor or moderate injury.

NOTICE

This shows an important notice

Make sure to read this information.

1.2 Intended users of the Installation instructions

The Installation instructions are primarily intended for the installer who mounts and wires up the controllers and displays. The Installation instructions can also be used for commissioning to check the installation.

1.3 Warnings and safety

Safety during installation and operation

When you install and operate the equipment, you may have to work with dangerous currents and voltages. The installation must only be carried out by authorised personnel who understand the risks involved in working with electrical equipment.

DANGER!

Hazardous live currents and voltages

Do not touch any terminals, especially the AC measurement inputs or any relay terminals, as this could lead to injury or death.

Disable the breakers

DANGER!

Disable the breakers

Unintended breaker closing can cause deadly and/or dangerous situations.

Disconnect or disable the breakers BEFORE you connect the controller power supply. Do not enable the breakers until AFTER the wiring and controller operation are thoroughly tested.

Disable the engine start

DANGER!

Unintended engine starts

Unintended engine starts can cause deadly and/or dangerous situations.

Disconnect, disable or block the engine start (the crank and the run coil) BEFORE you connect the controller power supply. Do not enable the engine start until AFTER the wiring and controller operation are thoroughly tested.

Electrostatic discharge

If the modules are not installed in the controller, protect the module terminals from electrostatic discharge. While the controller is open for the installation of modules, you must also protect the inside of the controller from electrostatic discharge.

Electrostatic discharge during installation can damage the modules and the inside of the controller.

Controller power supply

It is recommended that the controller has both a reliable power supply and a backup power supply. The switchboard design must ensure sufficient protection of the system, if the controller power supply fails.

Data security

The iE PLC includes a firewall.

While DEIF has taken great attention to data security and has designed the product to be a secure product, we recommend adopting Information Technology (IT) and Operational Technology (OT) security best practices when connecting the controller to a network.

To minimise the risk of data security breaches we recommend:

- Only connect to trusted networks and avoid public networks and the Internet.
- Use additional security layers like a VPN for remote access.
- Restrict access to authorised persons.

1.4 Legal information

Third party equipment

DEIF takes no responsibility for installation or operation of any third party equipment. In no event shall DEIF be liable for any loss of profits, revenues, indirect, special, incidental, consequential, or other similar damages arising out of or in connection with any incorrect installation or operation of any third party equipment.

Warranty

NOTICE

Warranty

The warranty will be lost if the warranty seals are broken.

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Copyright

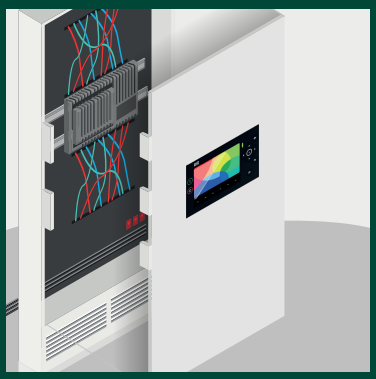
2. Prepare for installation

2.1 Mount options

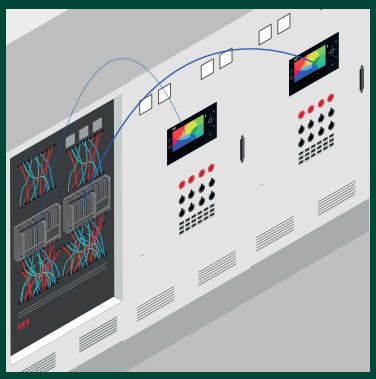
The iE 250 is highly flexible for different mounting locations.

Front mounted controller with combined display

Base mounted controller with or without local display



Base mounted controller with local or remote display



2.2 CAD drawings

DWG Drawings

DWG **iE 250** Front mounted with MIO

www.deif.com/rtd/ie250fmm/dwg

DWG **iE 250** Base mounted with MIO

www.deif.com/rtd/ie250bmm/dwg

DWG **iE 250** Base mounted without MIO

www.deif.com/rtd/ie250bm/dwg

DWG **iE 7** Local display

www.deif.com/rtd/ie7/dwg

STP STEP-file

STP **iE 250** Front mounted with MIO

www.deif.com/rtd/ie250fmm/stp

STP **iE 250** Base mounted with MIO

www.deif.com/rtd/ie250bmm/stp

STP **iE 250** Base mounted without MIO

www.deif.com/rtd/ie250bm/stp

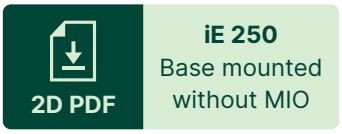
STP **iE 7** Local display

www.deif.com/rtd/ie7/stp

2D PDF

www.deif.com/rtd/ie250fmm/2dpdf

www.deif.com/rtd/ie250bmm/2dpdf



www.deif.com/rtd/ie250bm/2dpdf

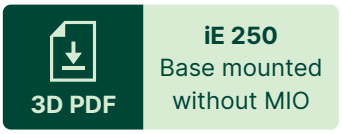
www.deif.com/rtd/ie7/2dpdf

3D PDF

To view a 3D PDF you must enable multimedia and 3D content in your PDF viewer.

www.deif.com/rtd/ie250fmm/3dpdf

www.deif.com/rtd/ie250bmm/3dpdf

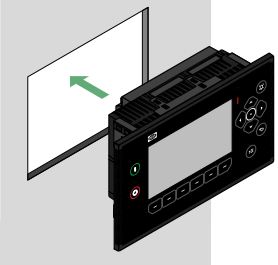


www.deif.com/rtd/ie250bm/3dpdf

www.deif.com/rtd/ie7/3dpdf

2.3 Location

2.3.1 Front mount controller or display



The front mount unit is designed to be mounted in a panel, with its back in an enclosure.

For UL/cUL listing, it must be:

- Mounted on a flat surface of a type 1 enclosure.
- Installed in accordance with the NEC (US) or the CEC (Canada).

The equipment must be installed and operated in a clean and dry environment, as specified in the Data sheet.

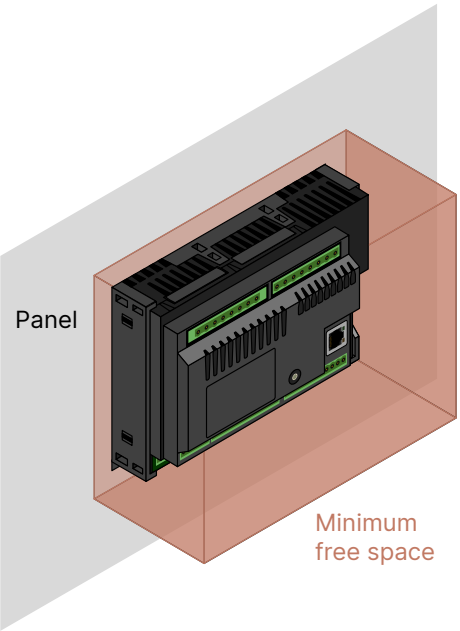
If the equipment is installed in an area subject to constant high vibrations, the equipment must be isolated from the vibrations. The installation environment must comply with the electrical, mechanical and environmental specifications of the equipment as described in the Data sheet.

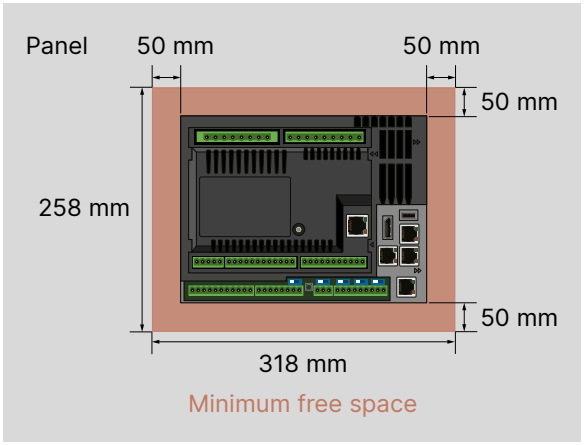
Ventilation requirements and spacing

The back of the unit is not protected against dust. Dust accumulation may damage the unit or lead to overheating. We recommend mounting the unit in a cabinet with a filter on the air supply.

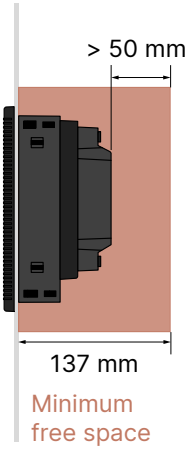
For proper ventilation, the unit must be mounted with its back vertical, and its long axis horizontal. The writing on the unit must be horizontal.

NOTE The display brightness may be affected if there is not enough ventilation.
The cable routing must not block the ventilation holes.





Back



Side

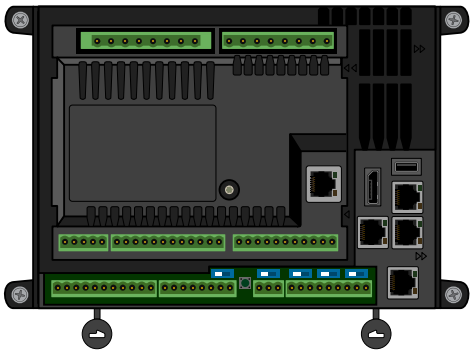
Inside the cabinet, there must be a minimum of 50 mm (2 in) free space above, below and at both sides of the unit. We recommend more than 50 mm (2 in) free space behind the unit for the cables and routing. Ethernet cables may require a minimum cable bend radius.

Total space requirement including minimum free space:
Height: 258 mm **Width:** 318 mm **Depth:** 137 mm

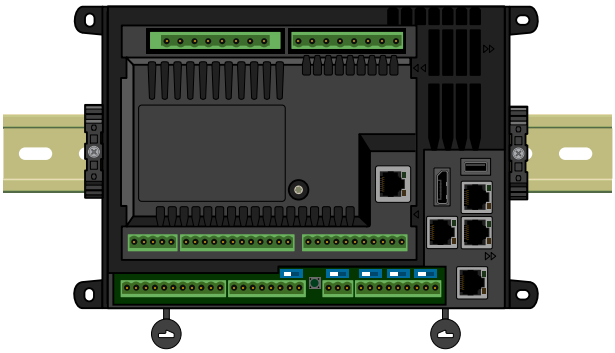
2.3.2 Base mount controller

The base mounted controller can be either mounted on a flat surface with screws/bolts or directly on a DIN 35 rail.

Mount on flat surface



Mount on DIN rail



For UL/cUL listing, it must be:

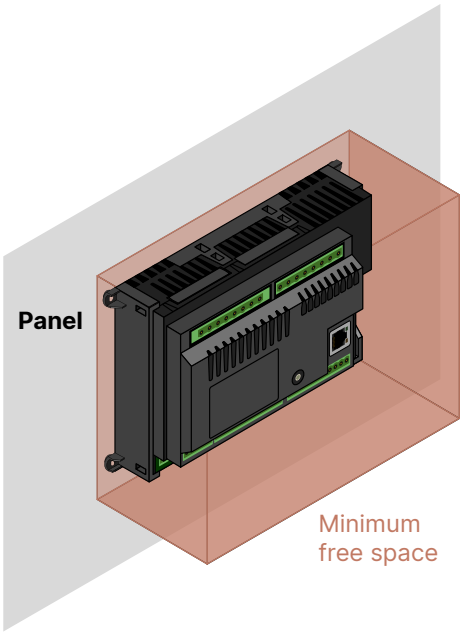
- Mounted on a flat surface of a type 1 enclosure.
- Installed in accordance with the NEC (US) or the CEC (Canada).

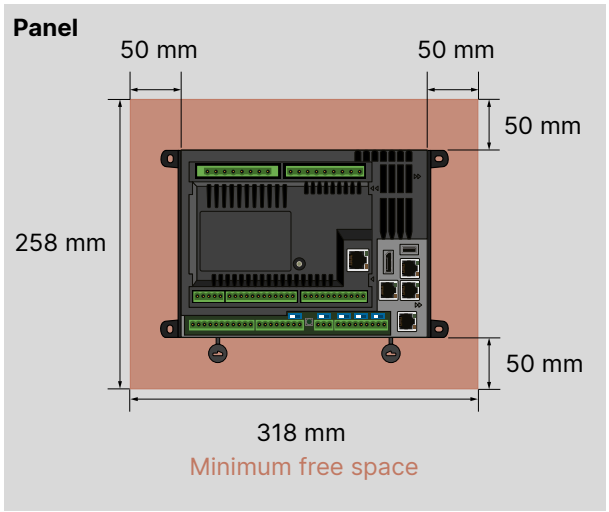
The equipment must be installed and operated in a clean and dry environment, as specified in the Data sheet.

The installation environment must comply with the electrical, mechanical and environmental specifications of the equipment as described in the Data sheet.

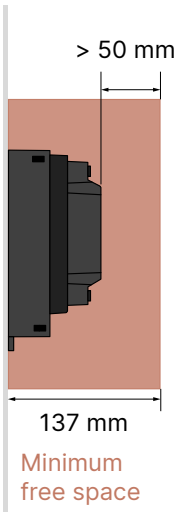
Ventilation requirements and spacing

Dust accumulation may damage the unit or lead to overheating. We recommend mounting the unit in a cabinet with a filter on the air supply. The cable routing must not block the ventilation holes.





Back

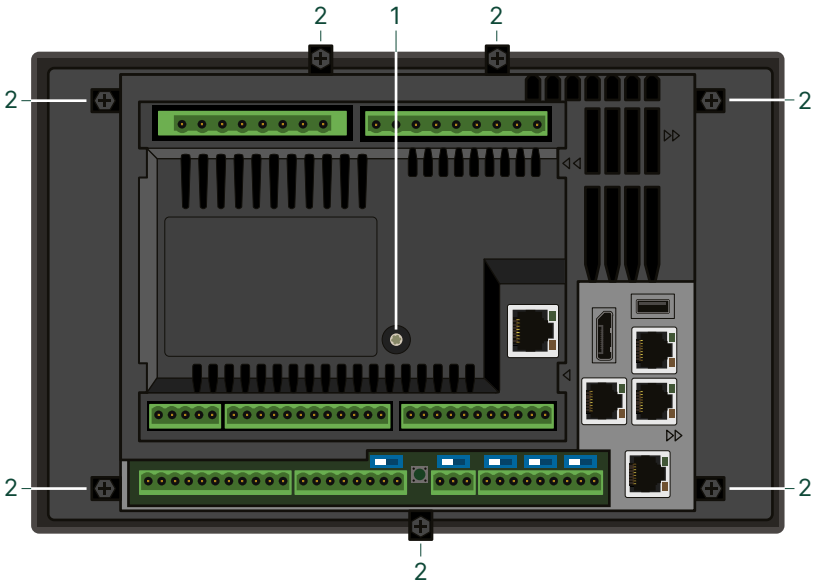


Side

Inside the cabinet, there must be a minimum of 50 mm (2 in) free space above, below and at both sides of the unit. We recommend more than 50 mm (2 in) free space behind the unit for the cables and routing. Ethernet cables may require a minimum cable bend radius.
Total space requirement including minimum free space:
Height: 258 mm **Width:** 318 mm **Depth:** 137 mm

2.4 Tools

2.4.1 Front mount controller or display



No.	Tool	Attachment	Torque	Used to
1.	Screwdriver	T15 (Torx plus 3.35 bit)	0.13 N·m (1.15 lb-in)	Remove or remount the MIO2.1 screw.
2.	Screwdriver	PH2 bit or a 5 mm (0.2 in) flat-bladed bit	0.1 N·m (0.9 lb-in)	Tighten the display unit fixing screw clamps.
-	Screwdriver	3 mm (0.12 in) flat-bladed bit	0.5 N·m (4.4 lb-in)	Connect the wiring to the 2.5 mm^2 terminals.
-	Wire stripper, pliers and cutters.	-	-	Prepare wiring. Trim cable ties.
-	Safety equipment	-	-	Personal protection according to local standards and requirements.
-	Conducting wrist strap	-	-	Prevent damage from electrostatic discharge.

NOTICE

Torque damage to equipment

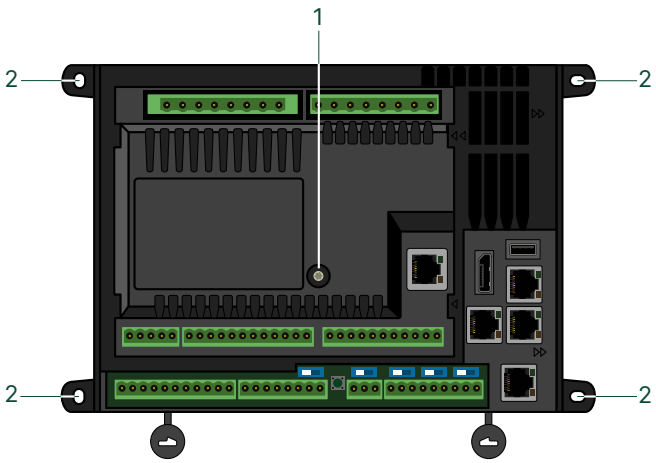
Do not use power tools during the installation. Too much torque damages the equipment.

Follow the instructions for the correct amount of torque to apply.

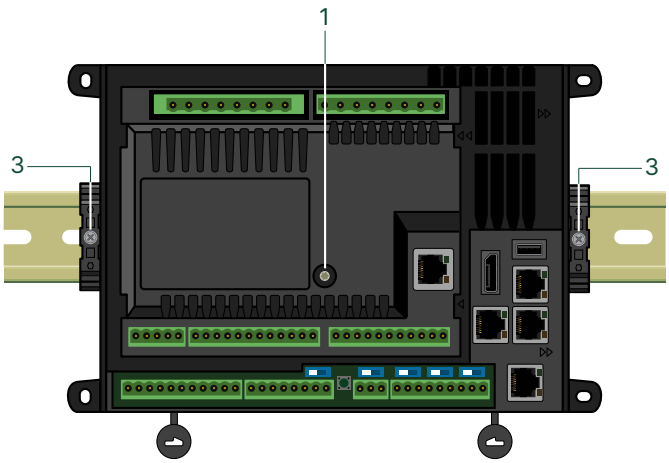
2.4.2 Base mount controller

The Base mounted controller can either be mounted on a flat surface with screws/bolts or directly on a DIN rail.

Mounted on surface



Mounted on DIN rail



No.	Tool	Attachment	Torque	Used to
1.	Screwdriver	T15 (Torx plus 3.35 bit).	0.15 N·m (1.3 lb-in).	Remove or remount the MIO2.1 screw.
2.	Screwdriver	Same as fixing type.	Same as fixing type.	Mount or remove the controller screws.
3.	Screwdriver	Same as fixing type.	Minimum 0.4 N·m Maximum 0.5 N·m	Tighten the DIN rail fixing screw clamps.
-	Screwdriver	3 mm (0.12 in) flat-bladed bit	0.5 N·m (4.4 lb-in)	Connect the wiring to the 2.5 mm² terminals.
-	Wire stripper, pliers and cutters.	-	-	Prepare wiring. Trim cable ties.
-	Safety equipment	-	-	Personal protection according to local standards and requirements.
-	Conducting wrist strap	-	-	Prevent damage from electrostatic discharge.

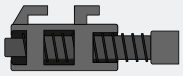
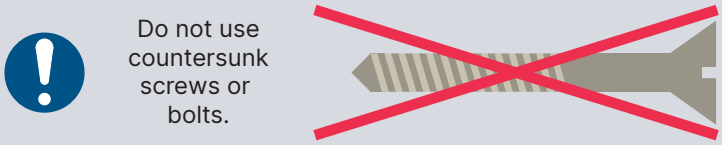
NOTICE

Torque damage to equipment

Do not use power tools during the installation. Too much torque damages the equipment.

Follow the instructions for the correct amount of torque to apply.

2.5 Additional materials

Material	Version	Notes
Seven screw clamps	Front mount or Local display	To mount the controller in the front panel.  x 7 Supplied with product.
Four bolts or screws	Base mount or extension racks.	To mount the controller on a flat surface, if not using the DIN rail fitting. **Screws**  **Bolts**  Not supplied with product. 
Wires and connectors	ALL	Wiring measuring points, DEIF equipment or any third party equipment to the controller terminals. Terminal blocks for the controller are supplied with product.
Fuses	ALL	Protect the controller and the wiring.
DIN rail clamps	Base mount	For additional securing to a DIN rail.
Ethernet cables	ALL	Connecting the controller communication between controllers, extension racks, and/or external systems.
USB cable	Base mount	Connecting the controller to the local display control.
DisplayPort cable	Base mount	Connecting the controller to the local display screen.
CAN cables	ALL	Connecting an ECU and/or external systems.
RS-485 cables	ALL	Connecting the controller via the communication ports COM 1 or COM 2.

2.6 Personal Protective Equipment (PPE)

Follow all local requirements and regulations for wearing PPE while you install or wire the product.

Example PPE but not limited to:

 Ear protection

 Eye protection

 Wear gloves

 Protective clothing

2.7 Safety and precautions

When you install and wire the equipment, you may have to work with or near dangerous currents and voltages. The installation must only be carried out by authorised personnel who understand the risks involved in working with electrical equipment.

Example safety precautions but not limited to:


Isolate power supply.


Ground the equipment.


Protect against static discharge.


Do not alter state during installation.

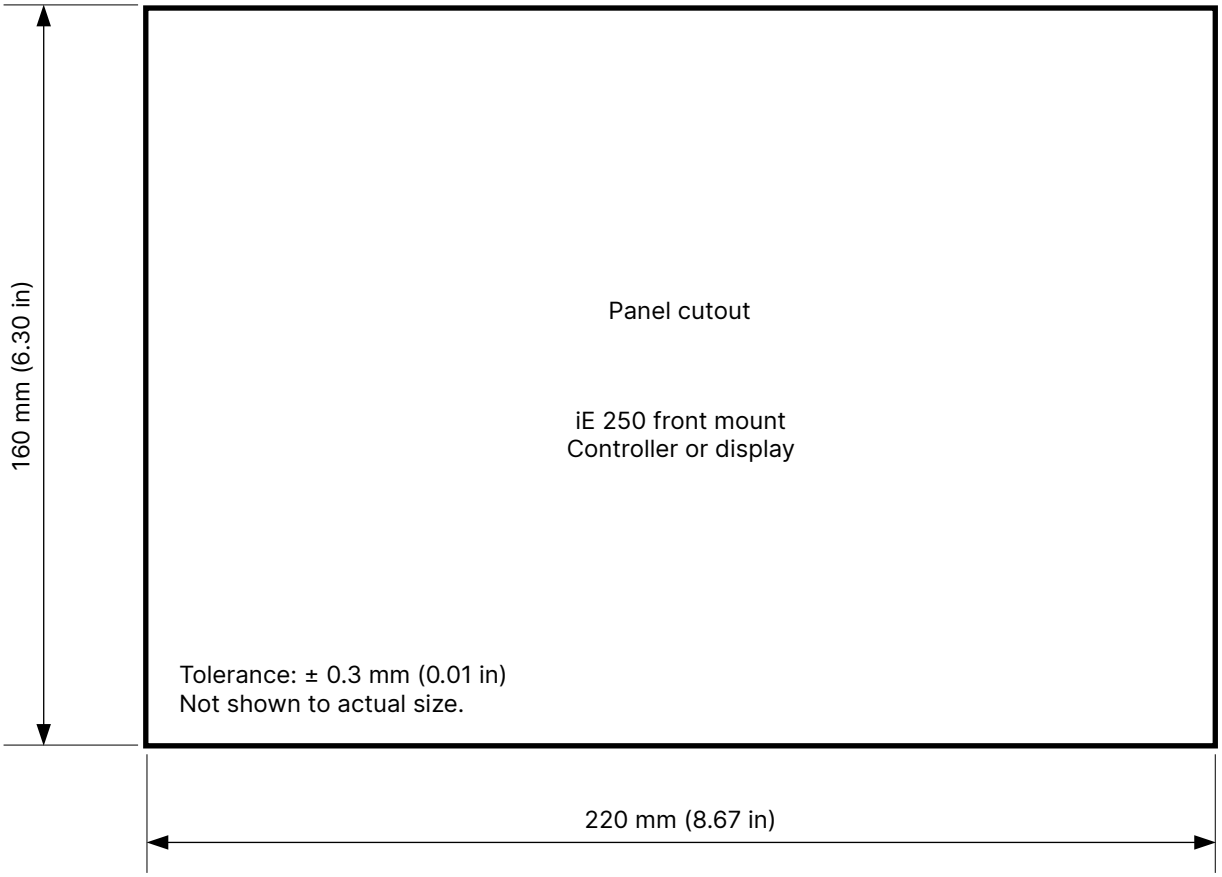
More information
See Warnings and safety for full details of all precautions to take during installation.

3. Mount the equipment

3.1 Front mount controller or display

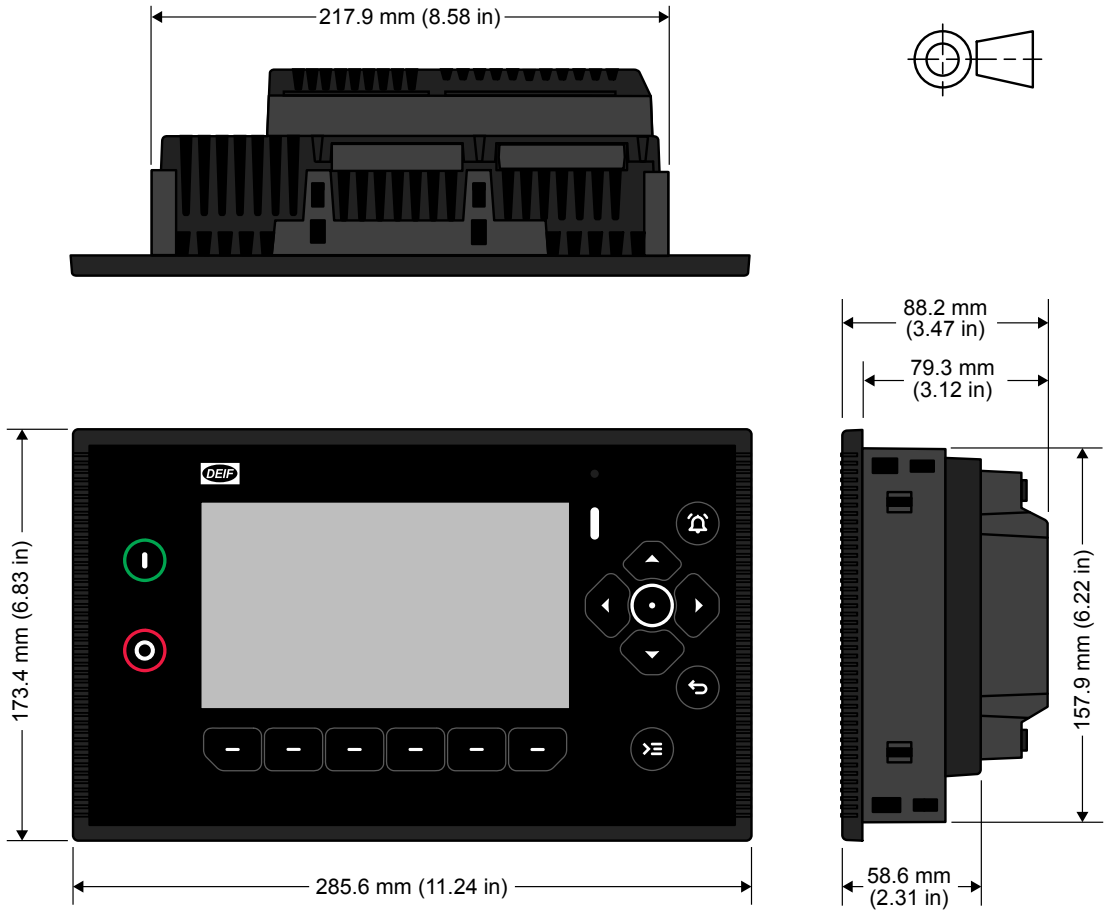
3.1.1 Panel cutout

This panel cutout drawing is a guideline and not scale 1:1. The dimensions will not be correct when printed. Use the dimensions given to create your panel cutout template.



Panel thickness must be less than 10 mm (0.39 in).

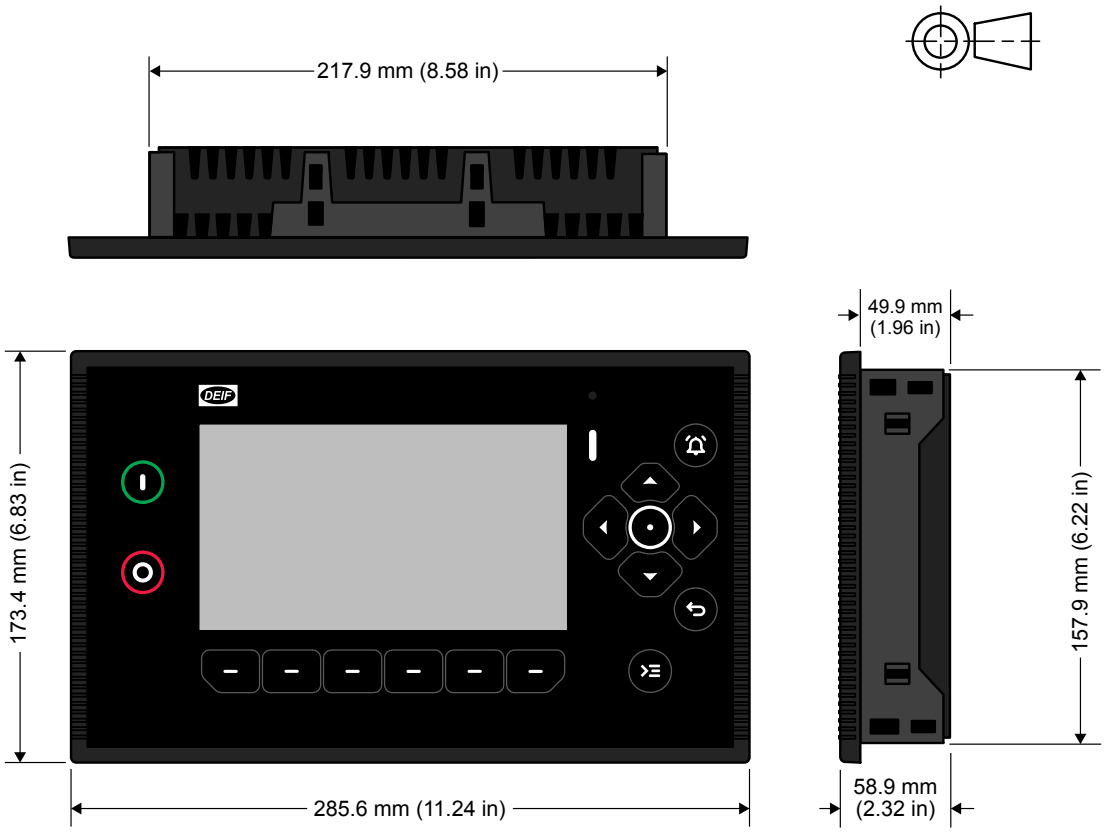
3.1.2 Front mounted controller with MIO2.1



Category	Specifications
Dimensions	**With MIO:** L×H×D: 285.6 × 173.4 × 88.2 mm (11.24 × 6.83 × 3.47 in) (outer frame) **Without MIO:** L×H×D: 285.6 × 173.4 × 58.6 mm (11.24 × 6.83 × 2.30 in) (outer frame)
Panel cutout	L×H: 220 × 160 mm (8.67 × 6.30 in) Tolerance: ± 0.3 mm (0.01 in)
Weight	**With MIO:** ~ 1233 g (2.72 lb)

Category	Specifications
Display	7", Projected Capacitive (PCAP), Touch
Resolution	1024×600 pixels (px)
Brightness	1200 Cd/m2
Processor	1.6 GHz quad-core industrial grade ARMv8 64 bit CPU with ECC protected cache

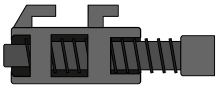
3.1.3 iE 7 Local display



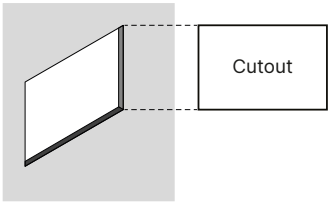
Category	Specifications
Dimensions	L×H×D: 285.6 × 173.4 × 58.9 mm (11.24 × 6.83 × 2.32 in) (outer frame)
Panel cutout	L×H: 220 × 160 mm (8.67 × 6.30 in)
Weight	840 g (1.9 lb)

Category	Specifications
Display	7", Projected Capacitive (PCAP), Touch
Resolution	1024×600 pixels (px)
Brightness	1200 Cd/m2
Processor	1.6 GHz quad-core industrial grade ARMv8 64 bit CPU with ECC protected cache

3.1.4 Mount the unit



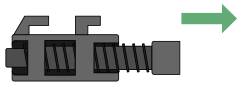
x 7 The unit is mounted with seven fixing screw clamps (supplied).

1. 

   Cut a rectangular hole in the panel to the correct size.

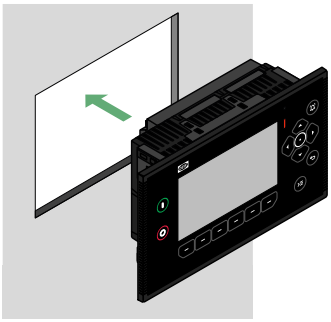
   See Panel cutout for the dimensions of the cutout.

   Panel thickness must be less than 10 mm (0.39 in).

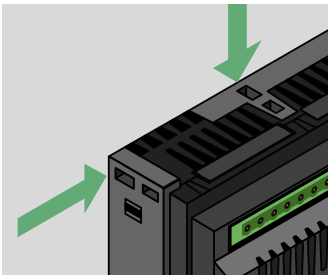
2. 

   Make sure that each fixing screw clamp is loosened to the position shown.

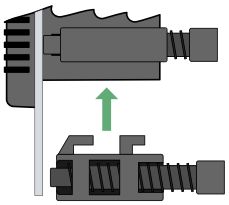
   Do not remove the fixing screw clamp completely from the holder.

3. 

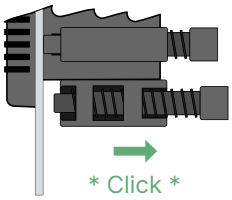
   Put the unit into the panel cutout.

4. 

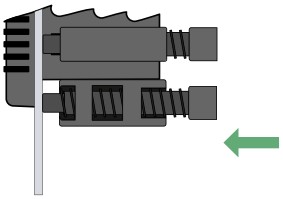
   Locate the holes for the fixing screw clamps on the unit.

5. 

   Put each fixing screw clamp into the mounting holes.

6. 

   Slide each fixing screw clamp into position.

7. 

Turn the fixing screw clamp until the unit is secure to the panel surface.

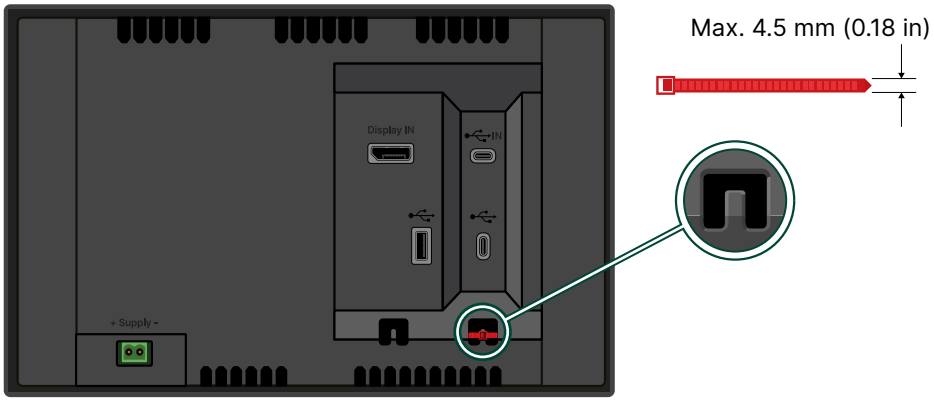
Do not exceed the recommended torque of 0.1 N·m (1.3 lb-in).

3.1.5 iE 7 cable strain relief

Cable tie slots

The iE 7 has two cable tie slots at the bottom of the display. For installations that may be subject to high vibrations, you must secure both the USB and DisplayPort cables using cable ties.

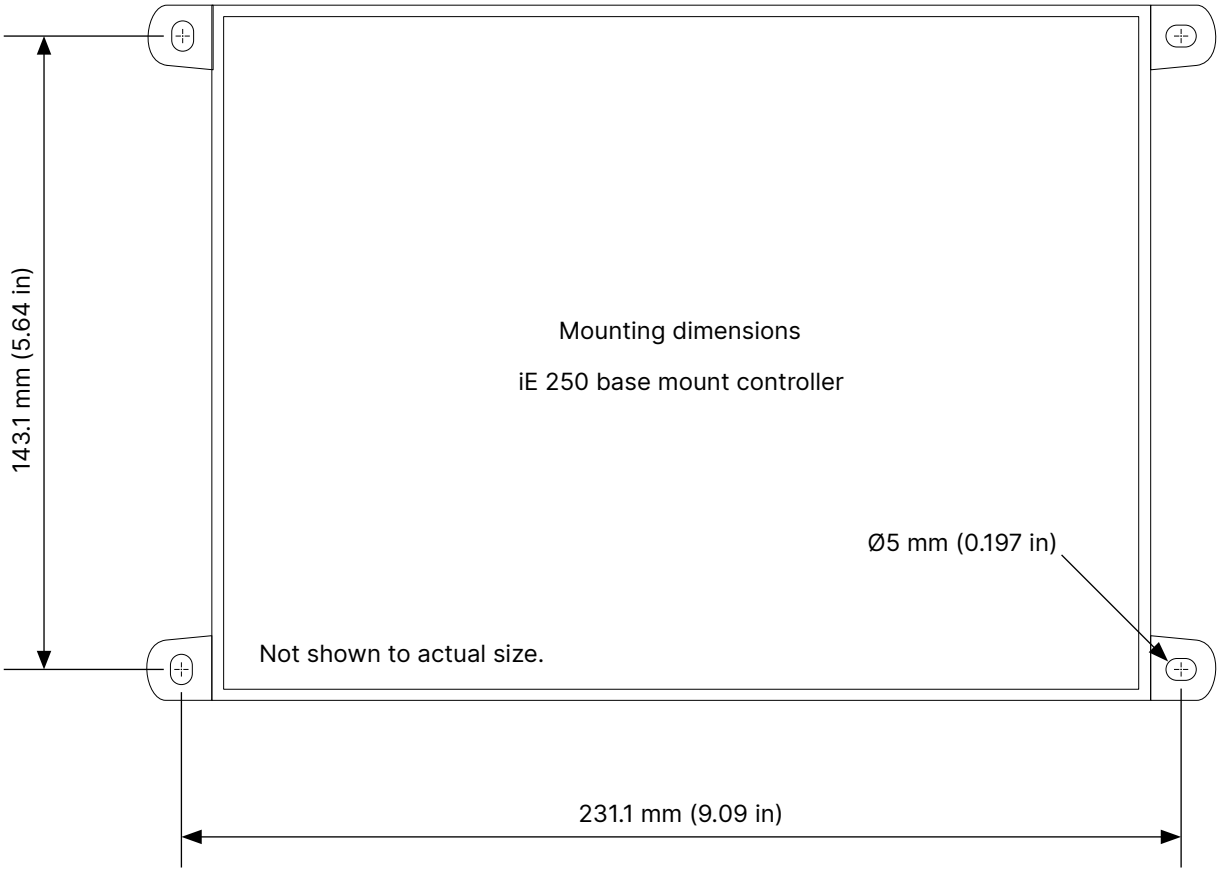
The maximum cable tie width is 4.5 mm (0.18 in).



3.2 Base mount controller

3.2.1 Mounting hole dimensions

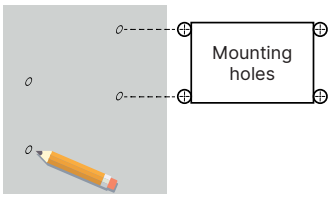
This dimension drawing is a guideline and not scale 1:1. The dimensions will not be correct when printed. Use the dimensions given to create your template.



3.2.2 Mount on flat surface

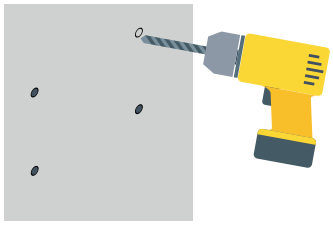
Fasteners for mounting the rack

Fasteners for mounting are **not** supplied with the controller. The base mount fasteners must be able to support the weight of the rack and the wiring.

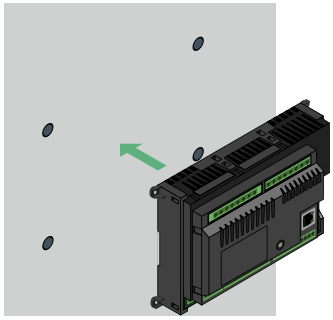
1. 

   Measure and mark the mounting holes on the surface.

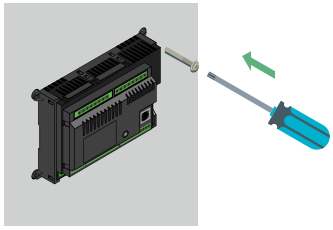
   See Mounting hole dimensions for the location of the mounting holes.

2. 

   Drill and tap the holes for mounting the rack.

3. 

   Align the base mount unit to the holes, including any washer as needed.

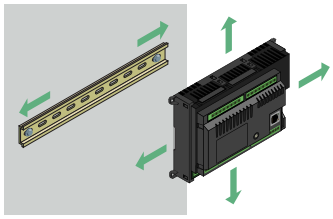
4. 

   Tighten all the fasteners until the unit is attached to the surface.

   Do not overtighten the fasteners and damage the frame.

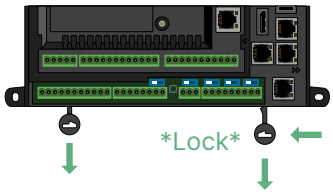
   Do not exceed the recommended torque of 0.1 N·m (1.3 lb-in).

3.2.3 Mount on DIN rail

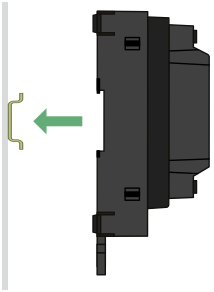
1. 

   Make sure there is enough free space both around the controller and either side of the DIN rail.

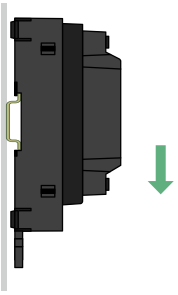
   See Base mount location for the free space requirements.

2. 

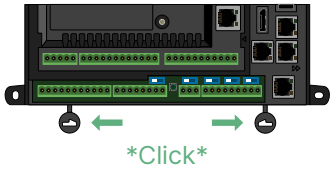
   Pull each DIN rail lock pin down and towards the middle of the controller, until they lock in place.

3. 

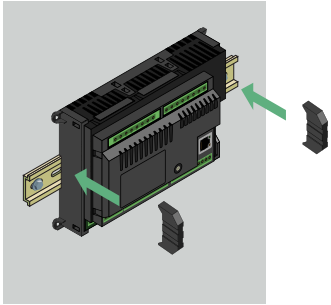
   Place the controller over the DIN rail.

4. 

   Move the controller down to hang on the DIN rail.

5. 

   Make sure the controller remains flat over the DIN rail and push both DIN rail lock pins outwards until they lock in place.

6. 

   Mount the DIN rail fixing clamps.

3.3 Add-on modules

3.3.1 No hot swapping modules

DANGER!

Do not hot swap modules

It is not allowed to hot swap any modules. Hot swapping modules can be extremely dangerous to both personnel and the equipment.

Make sure the system is shutdown and power supply has been isolated and switched off.

Isolate the power supply.

Protect the modules against static discharge.

Do not alter state during installation.

Avoid touching the PCB or terminal pins.

More information

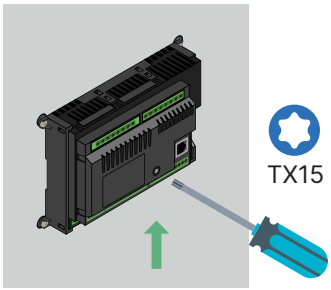
See Warnings and safety for full details of all precautions to take during installation.

3.3.2 Remove add-on module

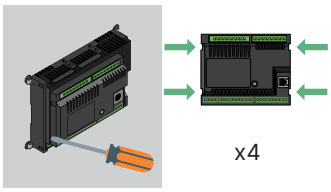
1. 

Protect the add-on modules against static discharge.

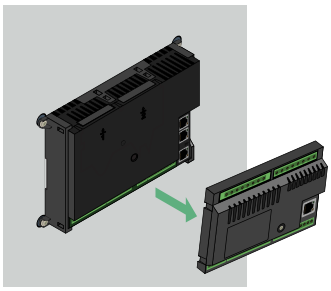
It is recommended to use a wrist strap connection to protect against Electrostatic discharge (ESD).

2. 

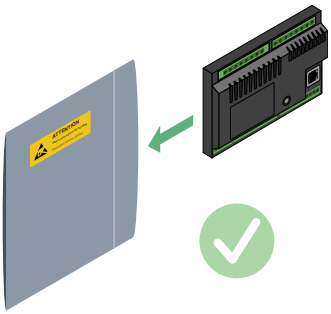
Use a T15 / TX15 bit on a long-nosed screwdriver to unscrew the add-on module.

3. 

Locate and use a flat blade screwdriver to unclip the add-on module.

4. 

Remove the add-on module.

5. 

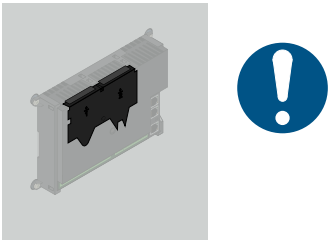
Put the add-on module in an ESD protective package when not installed in the controller.

3.3.3 Attach add-on module

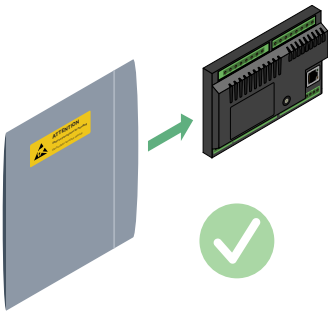
1. 

Protect the add-on modules against static discharge.

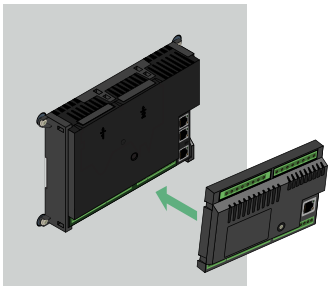
It is recommended to use a wrist strap connection to protect against Electrostatic discharge (ESD).

2. 

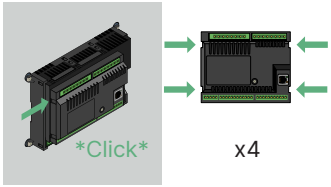
Make sure the plug-in module cover is in place.

3. 

Remove the add-on module from the ESD protective package.

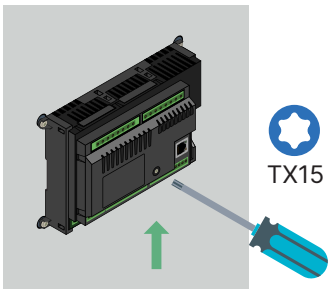
4. 

Align the add-on module with the PCB connector and 4 clip locations.

5. 

Hook the left side on first and then the right side.

Push the add-on module onto the controller, make sure all 4 locations are clipped into place.

6. 

Use a T15 / TX15 bit on a long-nosed screwdriver to tighten the add-on module.

Do not exceed the recommended torque of 0.13 N·m (1.3 lb-in).

3.4 Plug-in modules

3.4.1 No hot swapping modules

DANGER!

Do not hot swap modules

It is not allowed to hot swap any modules. Hot swapping modules can be extremely dangerous to both personnel and the equipment.

Make sure the system is shutdown and power supply has been isolated and switched off.

Isolate the power supply.

Protect the modules against static discharge.

Do not alter state during installation.

Avoid touching the PCB or terminal pins.

More information

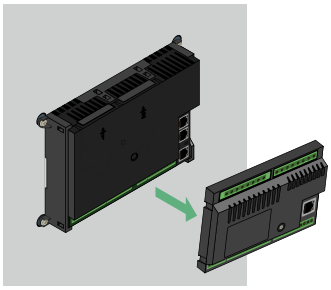
See Warnings and safety for full details of all precautions to take during installation.

3.4.2 Remove plug-in module

1. 

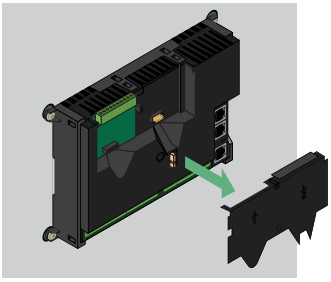
Protect the plug-in modules against static discharge.

It is recommended to use a wrist strap connection to protect against Electrostatic discharge (ESD).

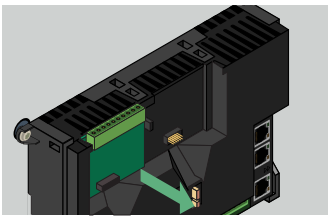
2. 

The add-on module must not be attached to remove the plug-in modules.

See Remove add-on module for how to remove the add-on module.

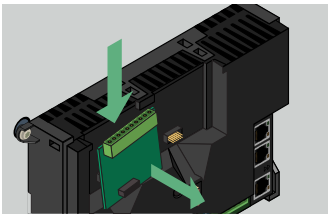
3. 

Remove the cover over the 2 plug-in slots.

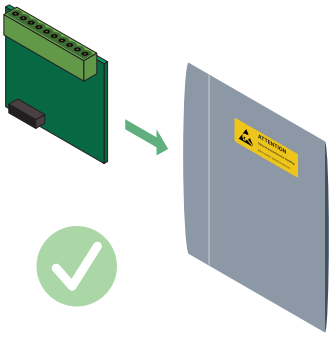
4. 

Carefully pull the bottom of the PCB to disconnect the terminal block.

If needed, only use a plastic chisel or similar plastic tool.

5. 

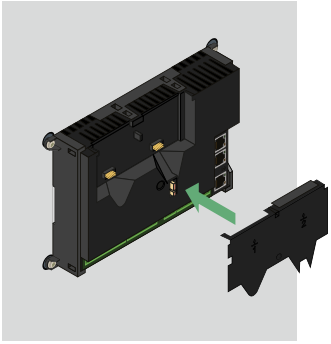
Pull the plug-in module down and away from the controller.

6. 

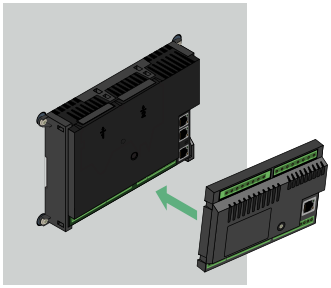
Hold the module by the outer edge only.

Do **not** touch the PCB.

Put the module in an ESD protective package when not installed in the controller.

7. 

Attach the cover over the 2 plug-in slots.

8. 

The add-on module can now be remounted.

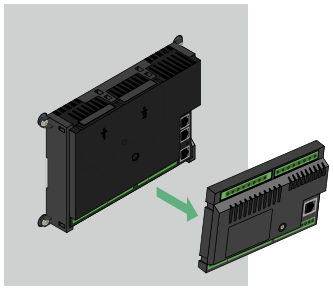
See Attach add-on module for how to attach the add-on module.

3.4.3 Attach plug-in module

1. 

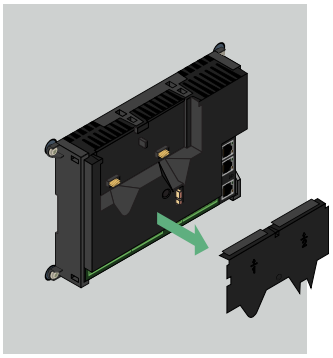
Protect the plug-in modules against static discharge.

It is recommended to use a wrist strap connection to protect against Electrostatic discharge (ESD).

2. 

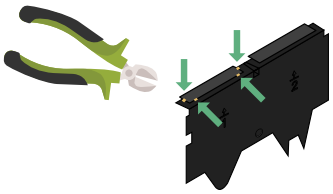
The add-on module must not be attached to install the plug-in modules.

See Remove add-on module for how to remove the add-on module.

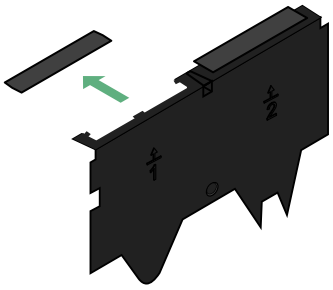
3. 

Remove the cover over the 2 plug-in slots.

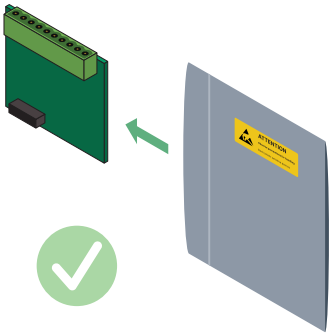
Release the snaplock in the holes marked with two arrows.

4. 

Cut the 4 lugs holding the slot cover.

5. 

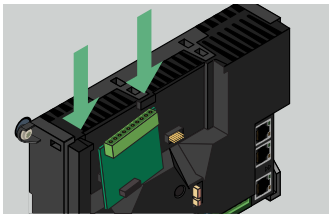
Remove the slot cover.

6. 

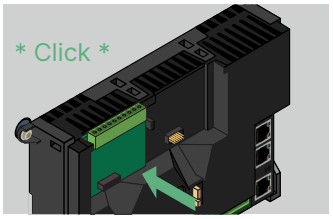
Remove the module from the ESD protective package.

Hold the module by the outer edge only.

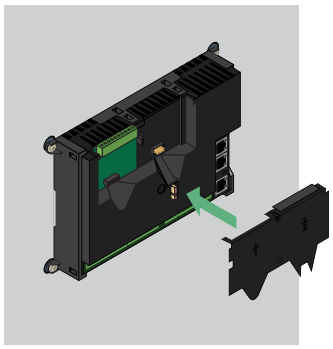
Do **not** touch the PCB.

7. 

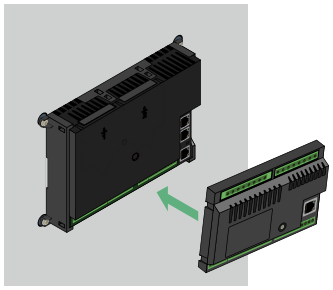
Hook the plug-in module in the top and tilt the PCB down without any force to the terminal block.

8. 

Make sure the terminal block on the PCB is aligned, and push the bottom of the PCB until the plug-in module clicks into position.

9. 

Hook the cover at the top and turn the cover downwards over the 2 plug-in slots.

10. 

The add-on module can now be remounted.

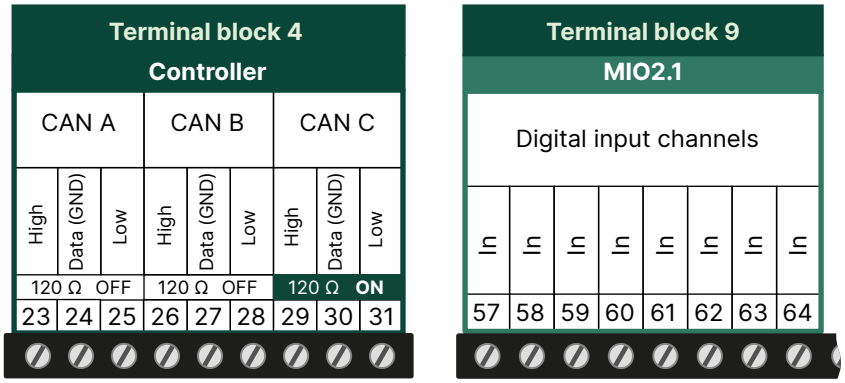
See Attach add-on module for how to attach the add-on module.

4. Wiring the equipment

4.1 About the wiring

4.1.1 Terminal locations

The example wiring in this manual shows if the terminals are located on the **Controller** or **MIO2.1**.



Some connections can be reconfigured to other terminals or hardware if needed.

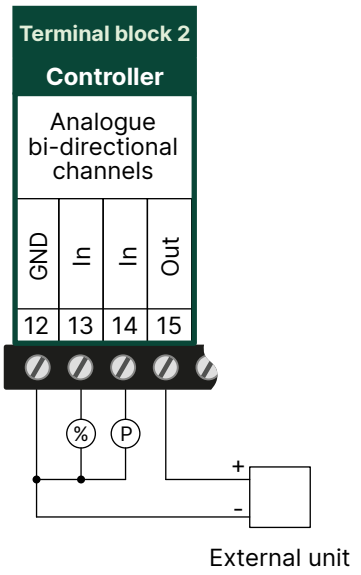
More information
See About the terminal connections for an overview of the terminals.

4.1.2 Bi-directional channels

Selected hardware has bi-directional channels. These can be configured as either input or output.

Mixed use with inputs and outputs

It is possible to use a mixture of inputs and outputs on the same terminal block.



External unit

4.1.3 Recommended fuses

Fuse		Block	Terminal(s)	Function	Rating
F1	Controller	1	1	DC (+)	5 A DC max. time-delay fuse/MCB, c-curve *
F2	Controller	1	7	DC (+)	2 A DC max. time-delay fuse/MCB, b-curve
F3	MIO2.1	8	46	DC (+)	3 A DC max. time-delay fuse/MCB, b-curve
F4	MIO2.1	9	64	DC (-)	6 A DC max. time-delay fuse/MCB, c-curve
F5	MIO2.1	8	52	DC (+)	2 A DC max. time-delay fuse/MCB, b-curve
F6	MIO2.1	6	78 to 81	A-side voltage measurement	2 A AC max. time-delay fuse/MCB, c-curve
F7	MIO2.1	6	83 to 86	B-side voltage measurement	2 A AC max. time-delay fuse/MCB, c-curve
F8	Display	1	1	DC (+)	2 A DC max. time-delay fuse/MCB, c-curve

NOTICE

Recommended fuse for high current draw

* For F1, if the supply is used for the crank or another high current draw can make the voltage drop below 12 V, then use a 6 A DC max. time-delay fuse/MCB, c-curve.

4.1.4 Technical specifications

You can find all of the technical specifications in the Data sheet:

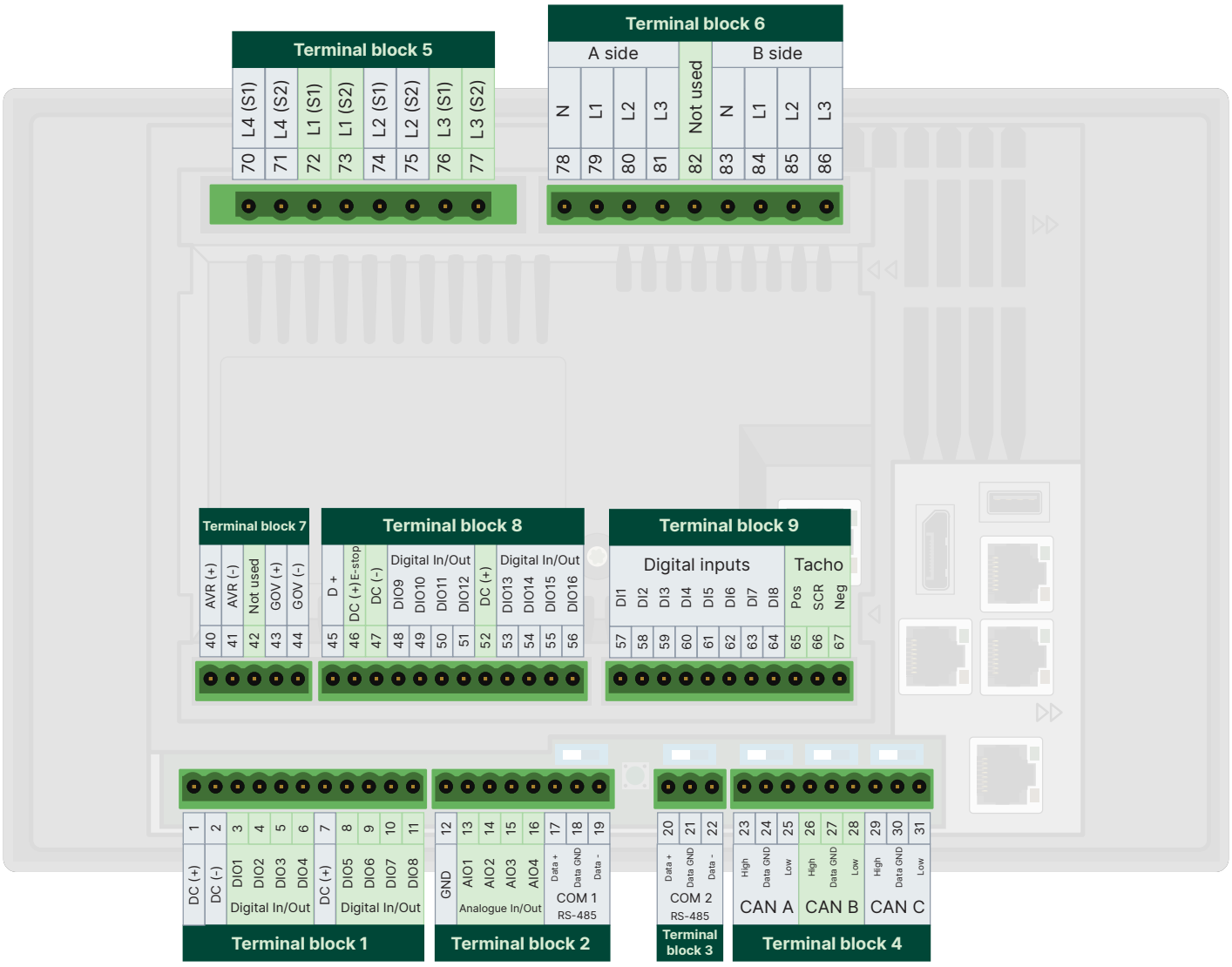
- iE 250 PLC Data sheet

4.2 Terminal connections

4.2.1 About the terminal connections

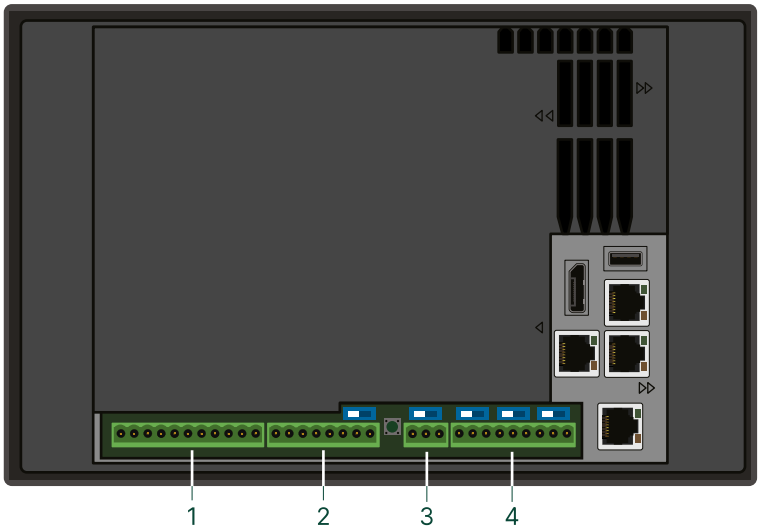
Only use the terminal blocks supplied by DEIF. Do not use substitutes.

Terminals for Controller with MIO2.1



No.	Location	Connections
Terminal block 1	Controller	Power / Digital bi-directional channels
Terminal block 2	Controller	Analogue bi-directional channels / COM1
Terminal block 3	Controller	COM2
Terminal block 4	Controller	CAN communication
Terminal block 5	MIO2.1	AC current
Terminal block 6	MIO2.1	AC voltage A-side, B-side
Terminal block 7	MIO2.1	Analogue outputs
Terminal block 8	MIO2.1	D+ / Digital bi-directional channels
Terminal block 9	MIO2.1	Digital input channels / Tacho

4.2.2 Front or base mounted controller



Terminal block 1 : Power / Digital bi-directional channels

Terminal	Function	Notes
1	Supply, DC (+)	Positive (+) supply for controller, channels 1 to 4 (terminals 3 to 6).
2	Supply, DC (-)	Negative (-) supply, common for channels 1 to 8 (terminals 3 to 11).
3	Digital bi-directional channel 1	**Modes** Disabled Digital input (sourcing) negative switching Digital input (sinking) positive switching Digital output (sourcing) Digital output (sourcing) with wire break detection
4	Digital bi-directional channel 2	
5	Digital bi-directional channel 3	
6	Digital bi-directional channel 4	
7	Supply, DC (+)	Positive (+) supply for channels 5 to 8 (terminals 8 to 11)
8	Digital bi-directional channel 5	**Modes** Disabled Digital input (sourcing) negative switching Digital input (sinking) positive switching Digital output (sourcing) Digital output (sourcing) with wire break detection
9	Digital bi-directional channel 6	
10	Digital bi-directional channel 7	
11	Digital bi-directional channel 8	

Terminal block 2 : Analogue bi-directional channels / COM1

Terminal	Function	Notes
12	GND	Common for analogue channels
13	Analogue bi-directional channel 1	
14	Analogue bi-directional channel 2	
15	Analogue bi-directional channel 3	
16	Analogue bi-directional channel 4	
17	COM1 Data + (A)	The built-in end resistor can be used for termination.
18	COM1 Data (GND)	
19	COM1 Data - (B)	

Terminal block 3 : COM2

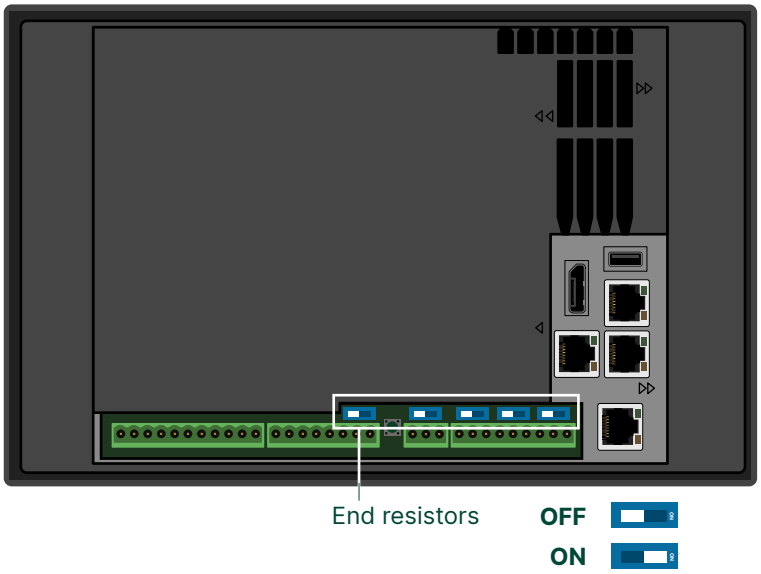
Terminal	Function	Notes
20	COM2 Data + (A)	The built-in end resistor can be used for termination.
21	COM2 Data (GND)	
22	COM2 Data - (B)	

Terminal block 4 : CAN

Terminal	Function	Notes
23	CAN A High	The built-in end resistor can be used for termination.
24	CAN A Data (GND)	
25	CAN A Low	
26	CAN B High	The built-in end resistor can be used for termination.
27	CAN B Data (GND)	
28	CAN B Low	
29	CAN C High	The built-in end resistor can be used for termination.
30	CAN C Data (GND)	
31	CAN C Low	

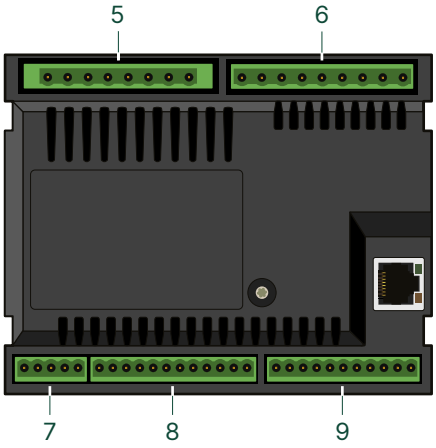
End resistors for CAN or COM (120 Ω Ohm)

Each COM and CAN connection can be terminated with the built-in end resistors located above the connection. Set the switch to **ON** to use the end resistor for the communication. The default setting is **OFF**.



4.2.3 Add-on modules

4.2.3.1 Measurement Input Output module (MIO2.1)



Terminal block 5: AC current

Terminal	Function	Notes
70	L4 (S1)	You can use S1 or S2 for the ground connection.
71	L4 (S2)	
72	L1 (S1)	You can use S1 or S2 for the ground connection.
73	L1 (S2)	
74	L2 (S1)	You can use S1 or S2 for the ground connection.
75	L2 (S2)	
76	L3 (S1)	You can use S1 or S2 for the ground connection.
77	L3 (S2)	

Terminal block 6: AC voltage A-side, B-side

Terminal	Function	Notes
78	N	A-side voltage measurements
79	L1	
80	L2	
81	L3	
82	Not used	
83	N	B-side voltage measurements
84	L1	
85	L2	
86	L3	

Terminal block 7: Analogue output

Terminal	Function	Notes
40	AO1 (+)	
41	AO1 (-)	
42	Not used	

Terminal	Function	Notes
43	AO2 (+)	
44	AO2 (-)	

Terminal block 8: Digital bi-directional channels and D+

Terminal	Function	Notes
45	D+	D+ alternator field winding.
46	DC (+) *	Positive (+) supply for channels 9 to 12 (terminals 48 to 51) and D+ (terminal 45). Supply for digital inputs 1 to 8 (terminals 57 to 64) (with DC (+) on terminal 52).
47	DC (-)	Negative (-) supply for channels 9 to 16 (terminals 48 to 51, and 53 to 56).
48	Digital bi-directional channel 9	Can be input or output also within groups, no hardware restrictions on mixed channels. **Modes** Disabled Digital input (sourcing) negative switching Digital output (sourcing) Digital output (sourcing) with wire break detection
49	Digital bi-directional channel 10	
50	Digital bi-directional channel 11	
51	Digital bi-directional channel 12	
52	DC (+) *	Positive (+) supply for channels 13 to 16 (terminals 53 to 56). Supply for digital inputs 1 to 8 (terminals 57 to 64) (with DC (+) on terminal 46).
53	Digital bi-directional channel 13	Can be input or output also within groups, no hardware restrictions on mixed channels. **Modes** Disabled Digital input (sourcing) negative switching Digital output (sourcing) Digital output (sourcing) with wire break detection
54	Digital bi-directional channel 14	
55	Digital bi-directional channel 15	
56	Digital bi-directional channel 16	

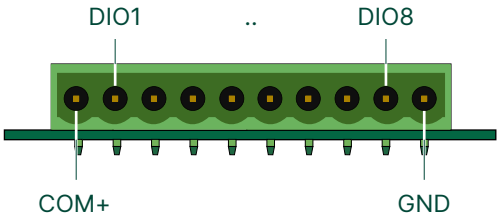
NOTE * This terminal can be used for an e-stop power cut-off. For more information, see E-stop power cut-off.

Terminal block 9: Digital input channels and tacho

Terminal	Function	Notes
57	Digital input 1	Digital input (sourcing) (negative switching) Digital input (sinking) (positive switching)
58	Digital input 2	
59	Digital input 3	
60	Digital input 4	
61	Digital input 5	
62	Digital input 6	
63	Digital input 7	
64	Digital input 8	
65	Tacho Pos.	Tacho inputs MPU, W, NPN, or PNP.
66	Tacho SCR	Tacho inputs MPU, W, NPN, or PNP.
67	Tacho Neg	Tacho inputs MPU, W, NPN, or PNP.

4.2.4 Plug-in modules

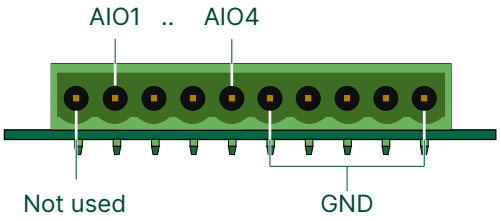
4.2.4.1 8 Digital bi-directional channels module



Terminal block : Digital bi-directional channels

Terminal	Function	Notes
99 / 109	COM+	Common for digital channels
98 / 108	Digital bi-directional channel 1	Can be input or output also within groups, no hardware restrictions on mixed channels. **Modes** Disabled Digital input (sourcing) negative switching Digital input (sinking) positive switching Digital output (sourcing) Digital output (sourcing) with wire break detection
97 / 107	Digital bi-directional channel 2	
96 / 106	Digital bi-directional channel 3	
95 / 105	Digital bi-directional channel 4	
94 / 104	Digital bi-directional channel 5	
93 / 103	Digital bi-directional channel 6	
92 / 102	Digital bi-directional channel 7	
91 / 101	Digital bi-directional channel 8	
90 / 100	Digital bi-directional ground	

4.2.4.2 4 Analogue bi-directional channels module



Terminal block : Analogue bi-directional channels

Terminal	Function	Notes
99 / 109	Not used	
98 / 108	Analogue bi-directional channel 1	
97 / 107	Analogue bi-directional channel 2	
96 / 106	Analogue bi-directional channel 3	
95 / 105	Analogue bi-directional channel 4	
90..94 / 100..104	GND	

4.3 AC wiring

4.3.1 Current transformer 3-phase wiring

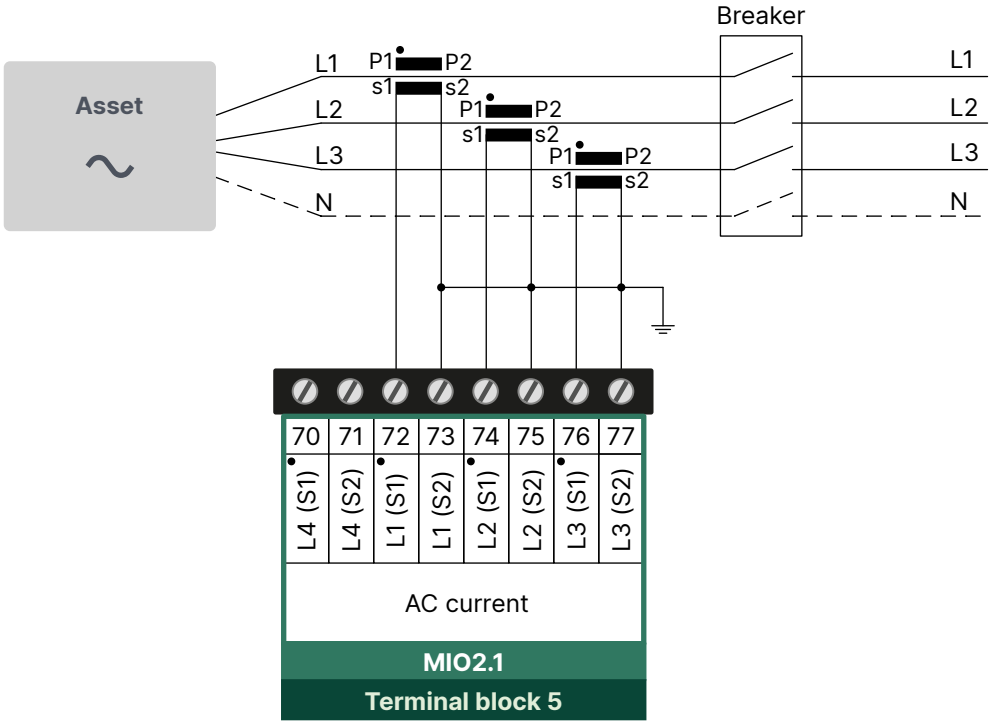
The current transformer ground connection can be made on S1 or S2 connection.

DANGER!

Failure to ground a current transformer could lead to injury or death

Make sure that each current transformer is grounded.

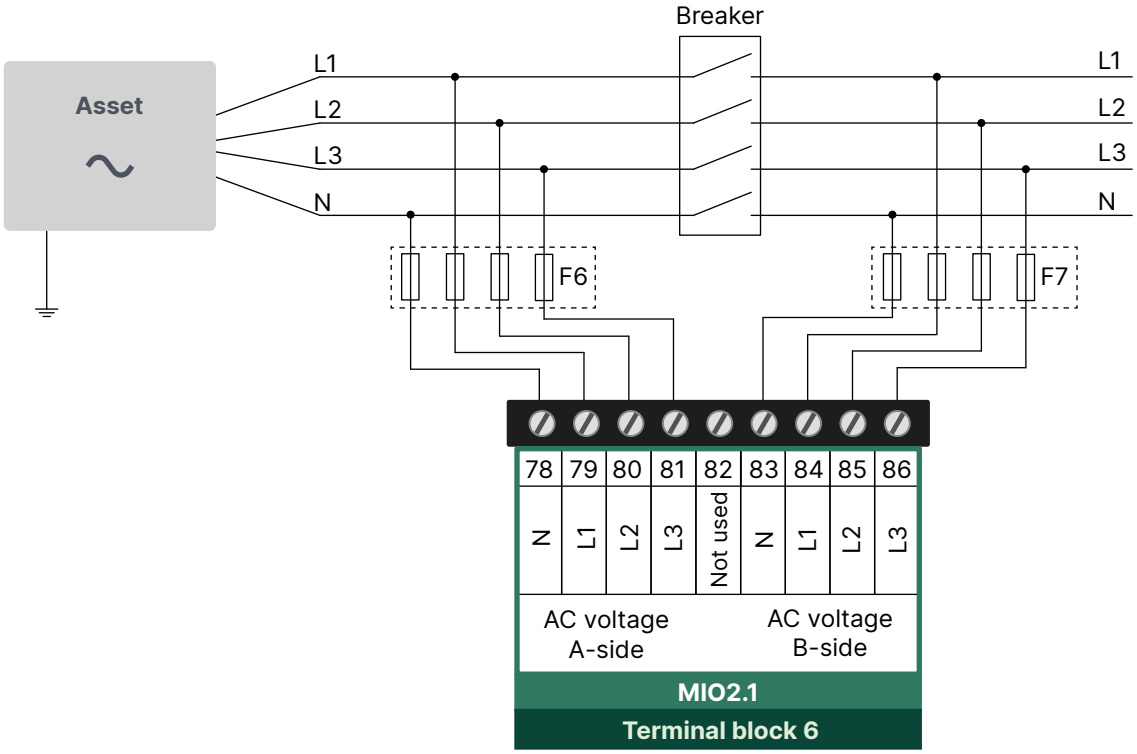
Current transformers for 3-phase application



4.3.2 Voltage measurement wiring

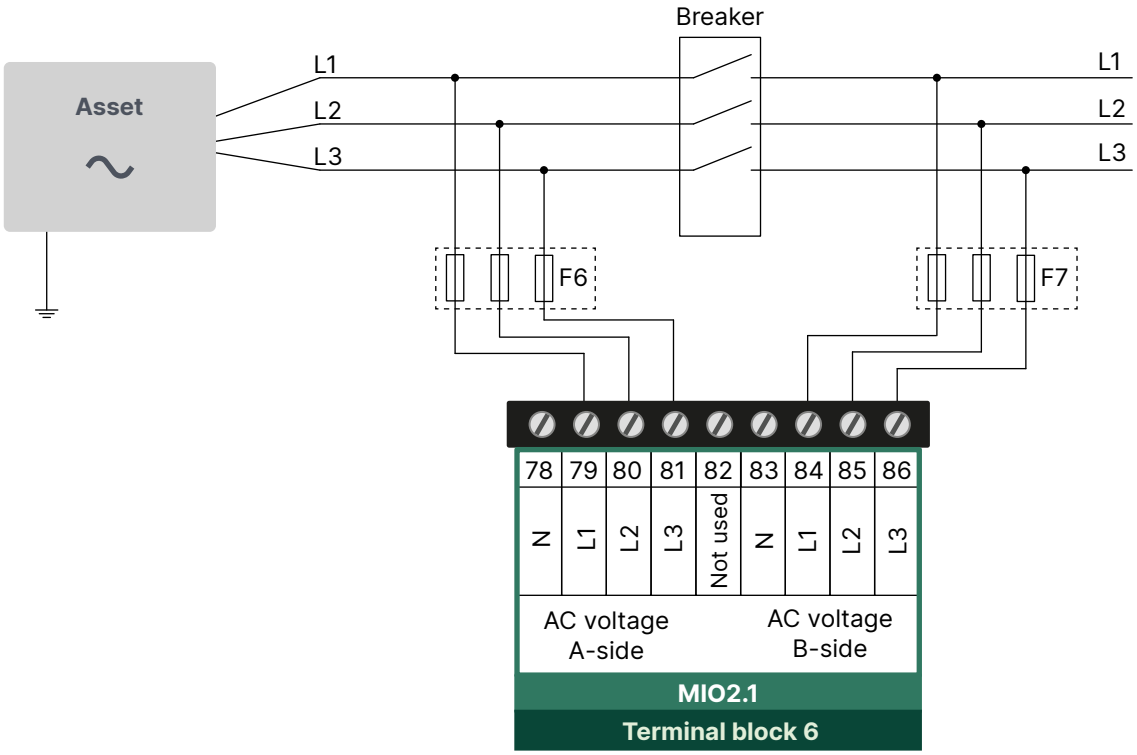
If the wires/cables must be protected with fuses, use max. 2 A time-delay fuses, dependent on the wires/cables to be protected.

Voltage measurements for 3-phase application (4 wires)



F6, F7: 2 A AC max. fuse/MCB, c-curve

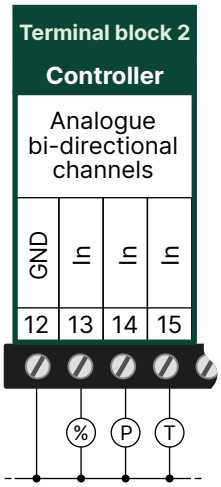
Voltage measurements for 3-phase application (3 wires)



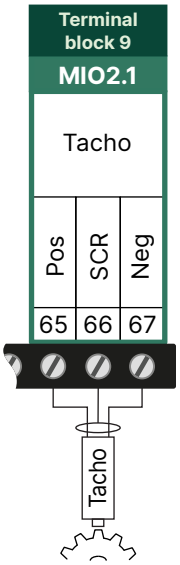
F6, F7: 2 A AC max. fuse/MCB, c-curve

4.3.3 Analogue inputs

Analogue sensor inputs

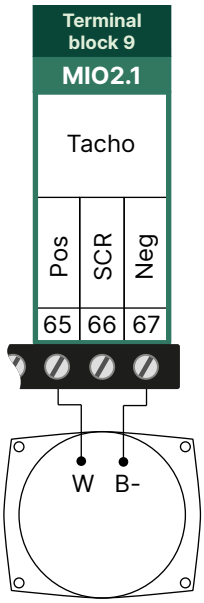


Analogue tacho input (MPU)



Connect the cable shield to terminal 66 (SCR).
Do not ground the cable.

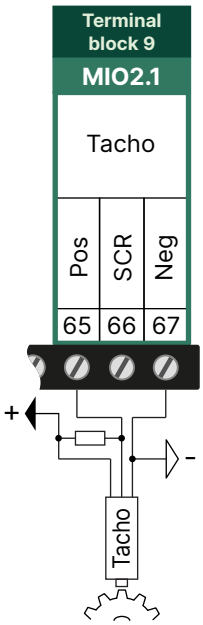
Analogue tacho input (W)



Charging alternator

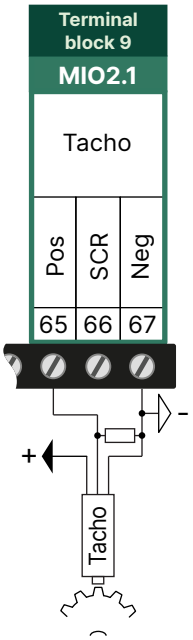
For W connections, the terminal 47 DC (-) must be connected to the Battery (-).

Analogue tacho input (NPN)



For NPN connections, the terminal 47 DC (-) must be connected to the Battery (-).

Analogue tacho input (PNP)



For PNP connections, the terminal 47 DC (-) must be connected to the Battery (-).

For most 12 V systems use a resistor with a value between 1 kΩ and 2.2 kΩ.
For most 24 V systems use a resistor with a value 2.2 kΩ.

NOTICE

Refer to sensor Data sheet

Always refer to the sensor manufacturer's Data sheet for the recommended resistor value or maximum sink current.

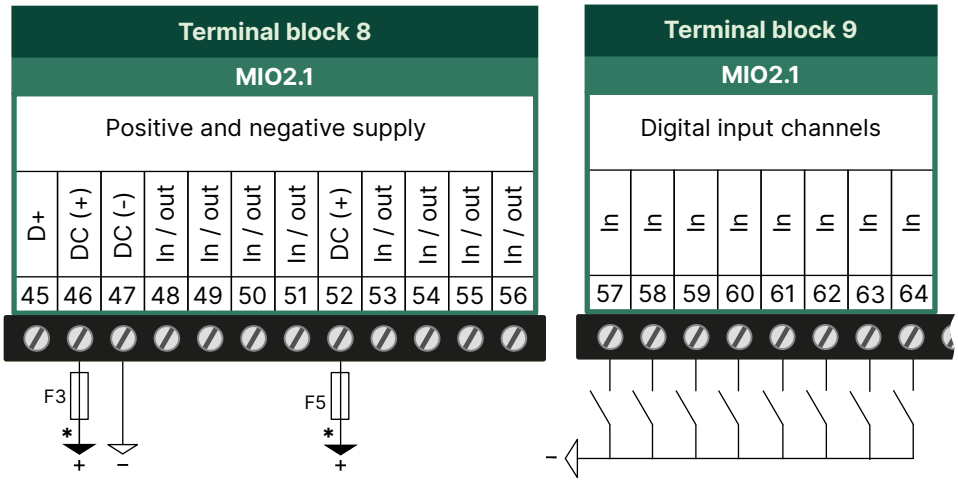
The resistor may be built in on some sensors, and therefore no external resistor is needed.

4.4 DC wiring

4.4.1 Digital inputs on MIO2.1

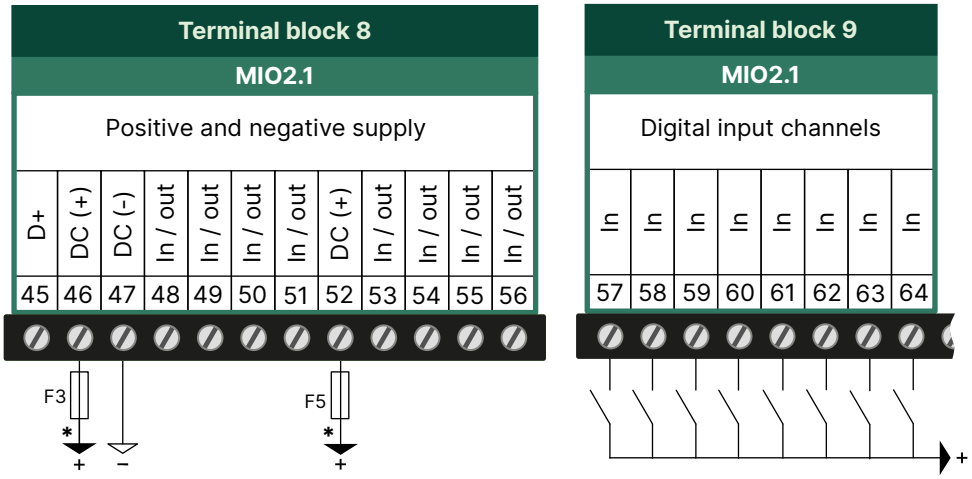
NOTE * The DC (+) supply (terminals 46 and/or 52) must be powered for these inputs to work. The DC (-) (terminal 47) must also be connected.

Sourcing (negative switching) digital inputs



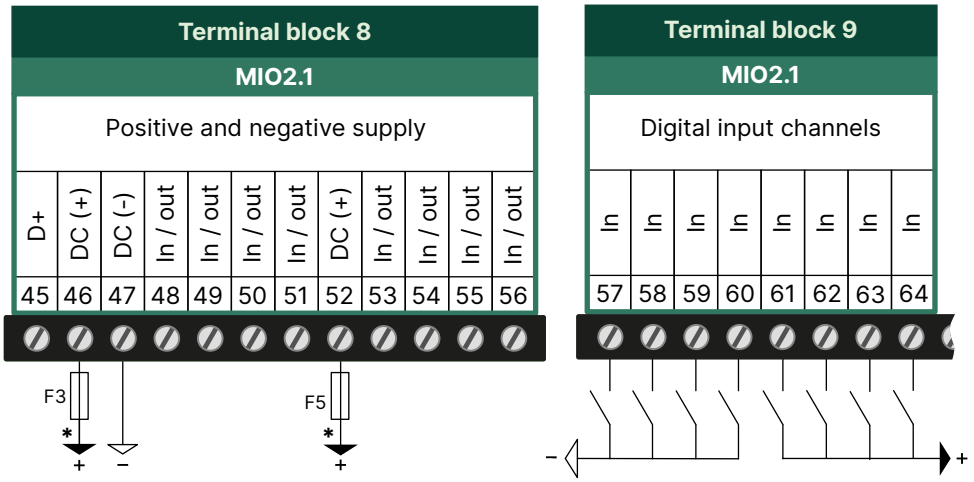
Source: A positive signal activates the input.

Sinking (positive switching) digital inputs



Sink: A negative signal activates the input.

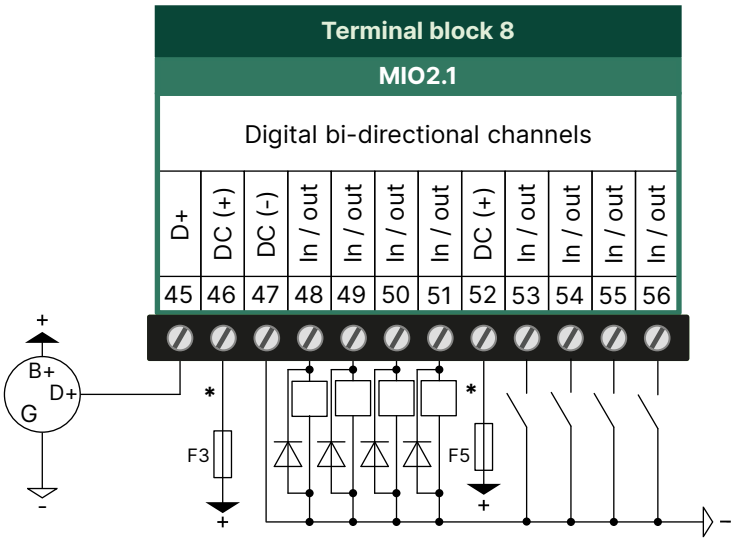
Mix of sinking and sourcing digital inputs (negative and positive switching)



4.4.2 Digital bi-directional channels

NOTE The DC (+) supply (terminals 46 and/or 52) must be powered for these channels to work. The DC (-) (terminal 47) must also be connected.

Digital inputs (negative switching) and outputs (sourcing) (example)



Fuses

F3: 3 A DC max. time-delay fuse/MCB, b-curve

F5: 2 A DC max. time-delay fuse/MCB, b-curve

NOTE * This terminal can be used for an e-stop power cut-off. For more information, see E-stop power cut-off.

4.4.3 E-stop power cut-off

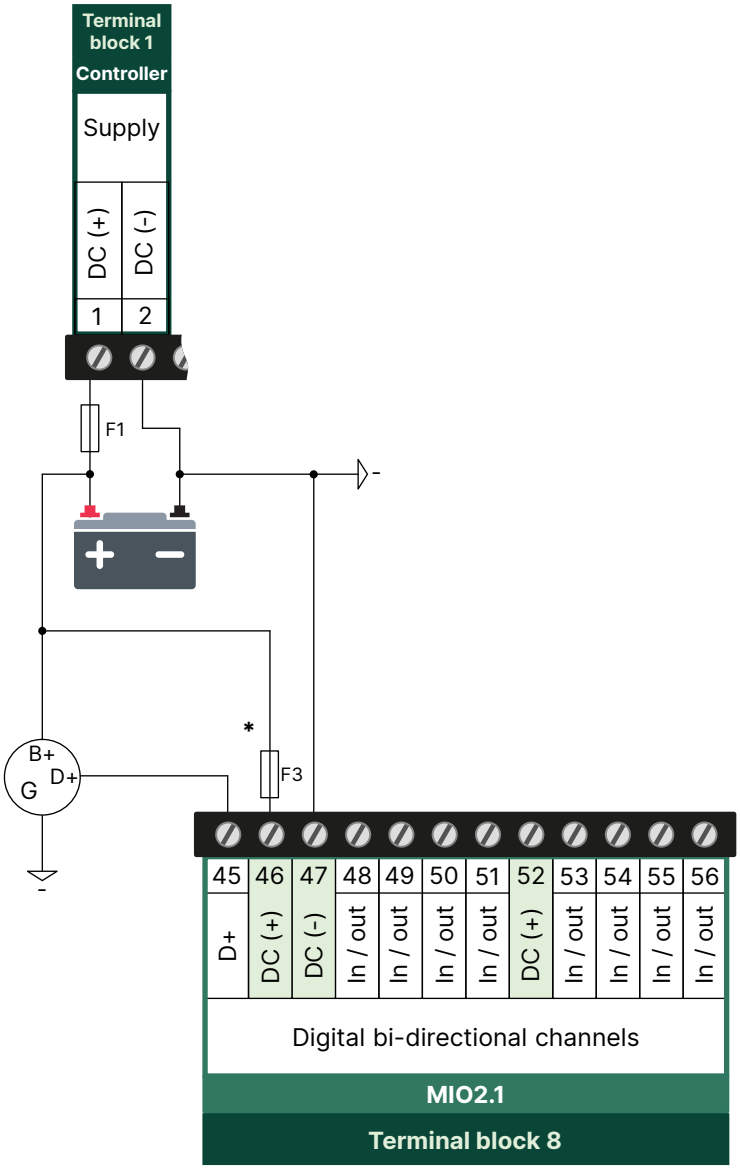
You can connect an external e-stop power cut-off to terminal 46. When the e-stop button is pressed, the power to D+ (terminal 45) and channels 9 to 12 (terminals 48 to 51) is cut off.

Alternatively, you can connect an external e-stop power cut-off to terminal 52. When the e-stop button is pressed, the power to channels 13 to 16 (terminals 53 to 56) is cut off.

When the DC (+) power to a channel used as an output is cut off, the output is low. When the DC (+) power to a channel used as an input is cut off, the channel can still detect signals.

NOTE The DC (+) supply (terminals 46 and/or 52) must be powered for digital inputs 1 to 8 (terminals 57 to 64) to work.

4.4.4 Power supply



Fuses

- F1: 5 A DC max. time-delay fuse/MCB, c-curve
- F3: 3 A DC max. time-delay fuse/MCB, b-curve

NOTE Remember to mount the freewheeling diodes.
NOTE * This terminal can be used for an e-stop power cut-off. For more information, see E-stop power cut-off.

NOTICE

Recommended fuse for high current draw

If the supply is used for the crank or another high current draw can make the voltage drop below 12 V, then for F1, use a 6 A DC max. time-delay fuse/MCB, c-curve.

Backup power supply

The equipment does not contain a backup power supply. The power supply source must therefore include the necessary power backup.

4.5 Communication wiring

4.5.1 Recommended cables for communication

CAN communication (Engine, DAVR) RS-485 communication (Modbus)
Belden 3105A or equivalent, 22 AWG (0.33 mm²) twisted pair, shielded, impedance 120 Ω (Ohm), < 40 mΩ/m, min. 95 % shield coverage.

Ethernet communication (network) or EtherCAT (Extension rack)
The cable must meet or exceed the SF/UTP CAT5e specification.

USB type A to C (Local display control)
USB cable must support USB 2.0. Recommended length 1.8 m (5.9 ft). Maximum length 3 m (9.8 ft).

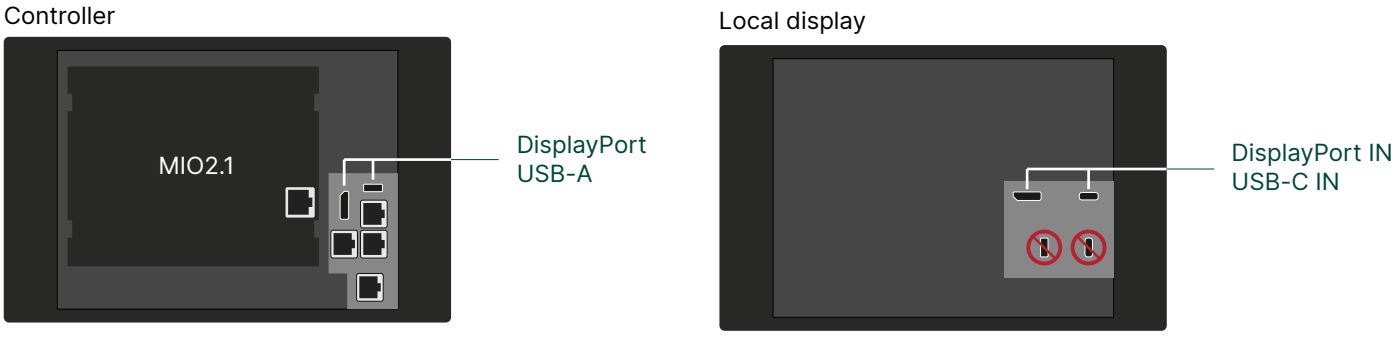
DisplayPort (Local display)
VESA DisplayPort compliant cable. Recommended length 1.8 m (5.9 ft). Maximum length 3 m (9.8 ft).

4.5.2 Display connections

4.5.2.1 iE 7 Local display connections

The Local display has inputs for **DisplayPort IN** and **USB type C IN**. It also has additional USB communication ports for future use.

The **DisplayPort IN** and **USB type C IN** are needed to connect and operate to the base mounted controller.



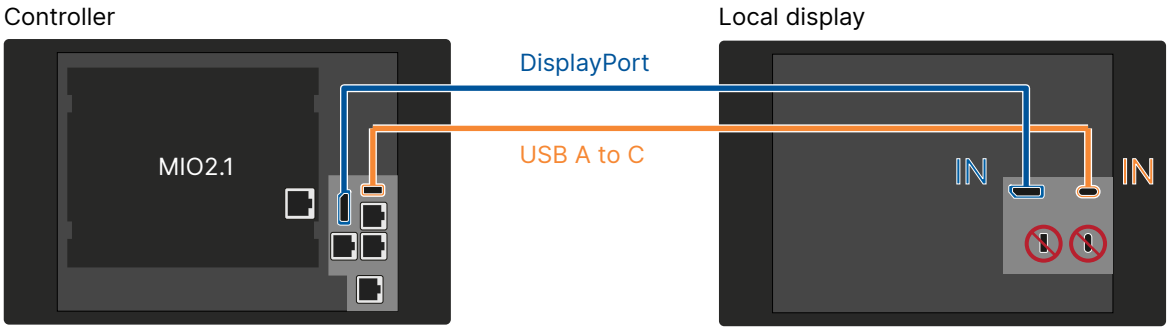
The additional USB ports on the Local display are for future use.

Connection constraints

- The Local display is only for use with a base mounted controller.
- The **DisplayPort IN** and **USB type C IN** cables must be connected to operate the base mounted controller.
- Controllers must be connected directly without a USB hub or similar.
- The DisplayPort cable is recommended to be 1.8 metres, point-to-point. Maximum length 3 metres, point-to-point.
- The DisplayPort cable must be a VESA DisplayPort compliant cable.
- The USB must be a Type A to Type C cable and is recommended to be 1.8 metres, point-to-point. Maximum length 3 metres.

- All USBs support 2.0.
- Both the DisplayPort and USB A to C cables are supplied. But otherwise they must meet or exceed the Data sheet specification.
- Connection to the Local display must use the ports marked **IN**.

Base mount controller to Local display connection



USB Connection to Local display must use USB IN.

4.5.2.2 External third-party display

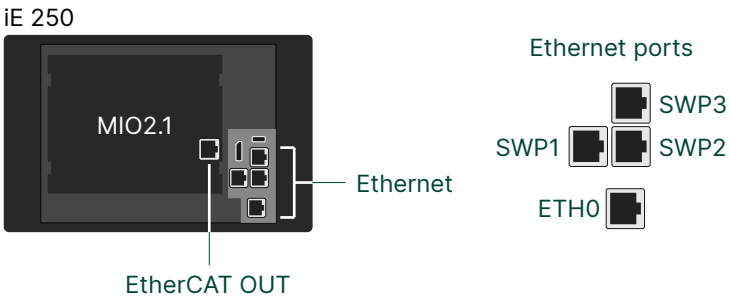
External third-party non-DEIF displays connected to the DisplayPort, should be configured to **Input** mode instead of **Automatic** detection.

4.5.3 EtherCAT connections

4.5.3.1 Ethernet and EtherCAT connections

The iE 250 has both Ethernet and EtherCAT communication ports.

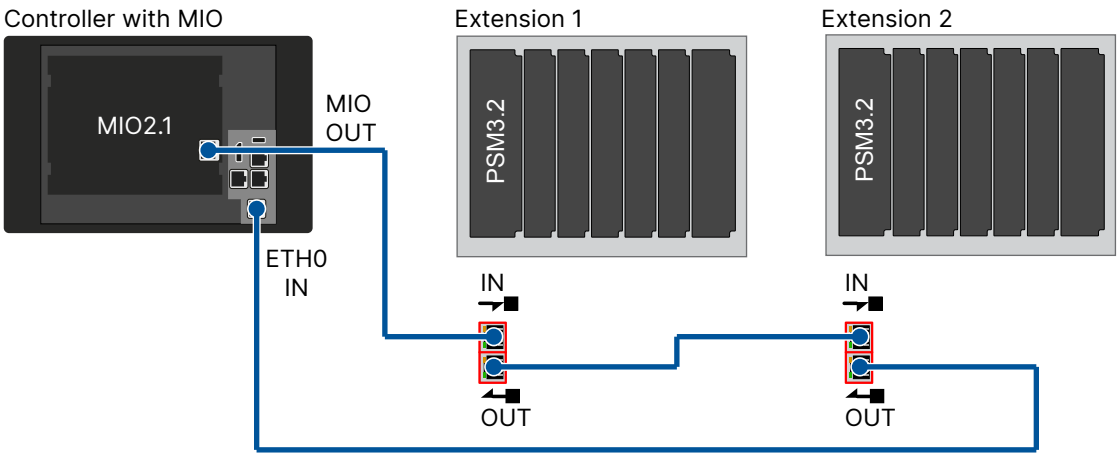
The EtherCAT connection is used for communication to extension racks.



The connection on the MIO add-on module is EtherCAT only.

4.5.3.2 Extension rack communication

Extension racks are connected to a controller using the EtherCAT port on the MIO2.1. Do not use this port for any other communication.



NOTE Redundant EtherCAT ring connections are only possible if wired back to **ETH0** and EtherCAT redundancy is enabled in the CODESYS project.

Internal communication requirements

The OUT port must always be connected to the IN port on the next extension rack.

Power off the extension rack(s) before you exchange or re-connect them to another controller.

- Up to 5 extension racks can be connected to the same controller.
- The controller and extension rack must be connected directly (without a switch between them).

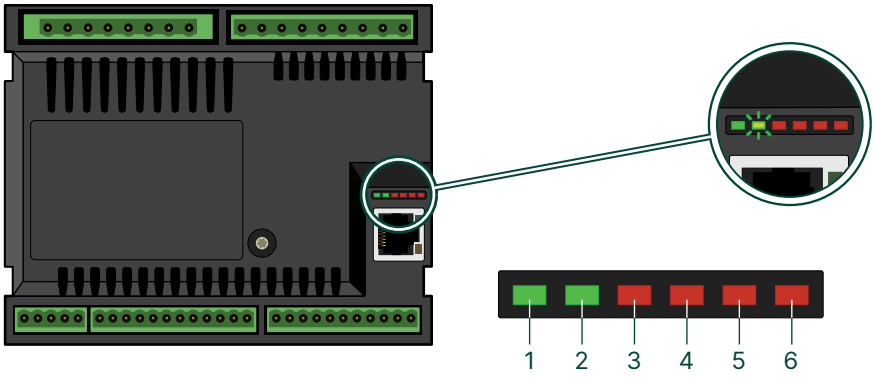
EtherCAT cable requirements

- The cables must not be longer than 100 metres from point-to-point.
- The cables must meet or exceed the SF/UTP CAT5e specification.
- The cable bend radius must not be tighter than the minimum bend radius specified by the cable manufacturers.
  - We recommend that you always follow the cable manufacturer's bend radius requirements.
  - It is recommended to use velcro-strips (and not cable-ties) for the Ethernet cables.

More information
See **Fieldbus configuration** in the PICUS manual for how to configure communication with extension rack(s).

4.5.3.3 EtherCAT LEDs

The communication status for the EtherCAT connection is shown directly above the port. This indicates both internal communication between the controller and the MIO2.1, and the external connected equipment. These can be useful for troubleshooting communication issues.



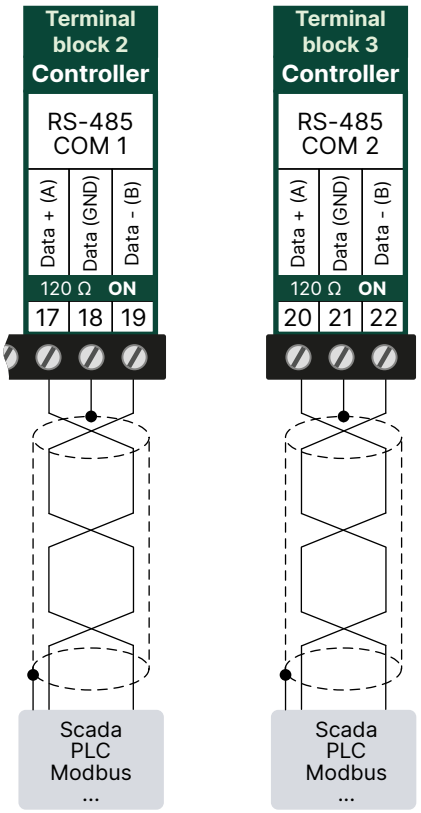
LED	Notes
1.	EtherCAT run.
2.	Link/activity to controller.
3.	Receive error from controller.
4.	Receive error from external equipment.
5.	Error.
6.	Reserved.

4.5.4 Serial communication COM 1 / COM 2

Can be used for example to Modbus RTU, SCADA systems, or PLCs.

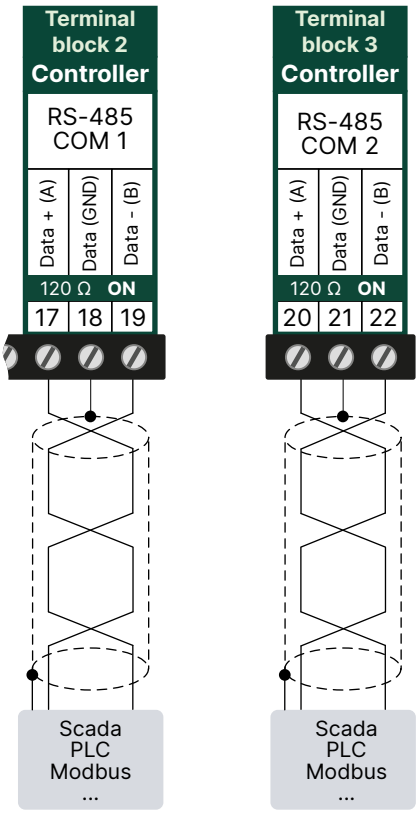
2-wire connection

With 2-wires, connect the GND terminal to the cable shield. Only connect the shield to earth at one end.



3-wire connection

Only connect the shield to earth at one end.



4.5.5 Ethernet connections

4.5.5.1 Network constraints

- Controllers must be connected with **Network chain** or **Network ring** configurations.
- Up to 32 controllers can be connected to each other in each network.
- The cables must not be longer than 100 metres, point-to-point.
- The cables must meet or exceed the SF/UTP CAT5e specification.
- The network to PICUS, SCADA, AMS and/or Modbus must be connected to the controllers as branches of the **Network chain** or **Network ring**. Do not place these network connections inside the network chain or ring.
- If you use an Ethernet switch, this must support and be enabled for Rapid Spanning Tree Protocol (RSTP), otherwise a broadcast storm will occur.
- For maritime applications, a maritime classification society approved managed switch should be used to connect the DEIF network to your own network. (An ordinary Ethernet switch is not recommended).
- The EtherCAT port on the MIO2.1 can not be used for Ethernet communication. It is used for EtherCAT communication to extension racks.
- The Ethernet 0 (ETH0) port on the controller can not be used for communication between DEIF controllers (that is, for the DEIF network Ethernet). Use the Ethernet switch ports 1 to 3.

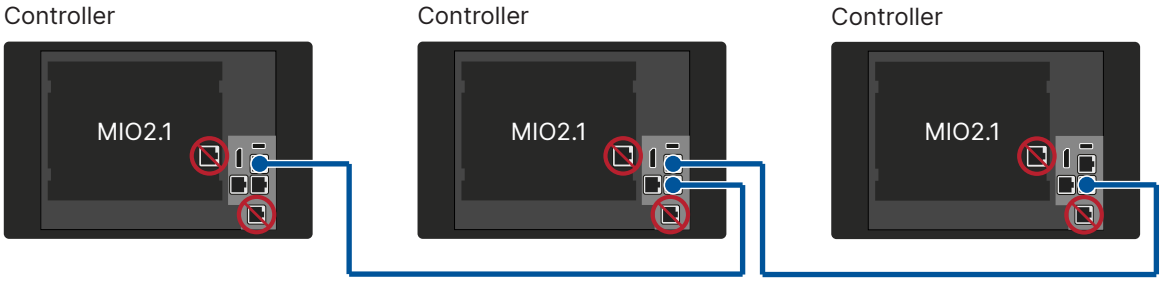
4.5.5.2 Ethernet communication

The Ethernet ports are not assigned to a particular service. By default these are configured as Automatic. The controllers detect the equipment connected to the port.

Network constraints

- The cables must not be longer than 100 metres, point-to-point.
- The cables must meet or exceed the SF/UTP CAT5e specification.
- The network to SCADA, AMS and/or Modbus must be connected to the controllers as branches of the **Network chain** or **Network ring**. Do not place these network connections inside the network chain or ring.
- If you use an Ethernet switch, this must support and be enabled for Rapid Spanning Tree Protocol (RSTP), otherwise a broadcast storm will occur.
- For maritime applications, a maritime classification society approved managed switch should be used to connect the DEIF network to your own network. (An ordinary Ethernet switch is not recommended).
- The EtherCAT port on the MIO2.1 can not be used for Ethernet network communication. It is used for EtherCAT communication to extension racks.
- The Ethernet 0 (ETH0) port on the controller can not be used for Ethernet network communication. Use the Ethernet switch ports 1 to 3.

Network chain

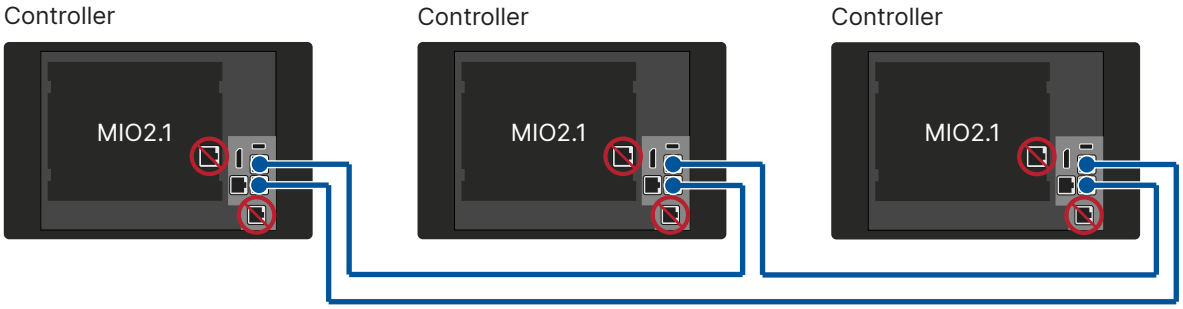


Standard Ethernet network (sub-ring)

Do not use the EtherCAT port on the MIO2.1 for Ethernet network communication.

Do not use the ETH0 port on the controller for Ethernet network communication.

Network chain (with redundancy connection)

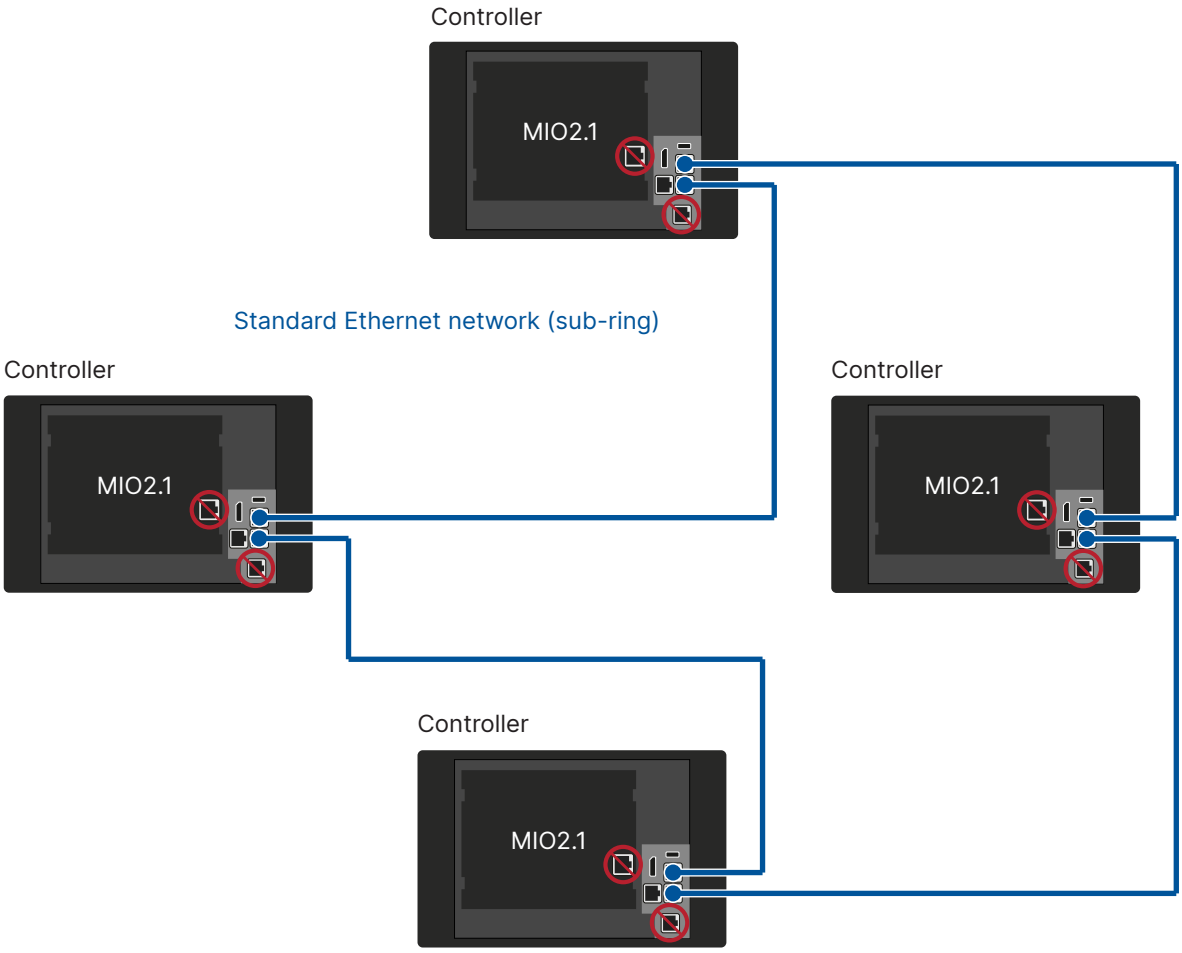


Standard Ethernet network (sub-ring)

Do not use the EtherCAT port on the MIO2.1 for Ethernet network communication.

Do not use the ETH0 port on the controller for Ethernet network communication.

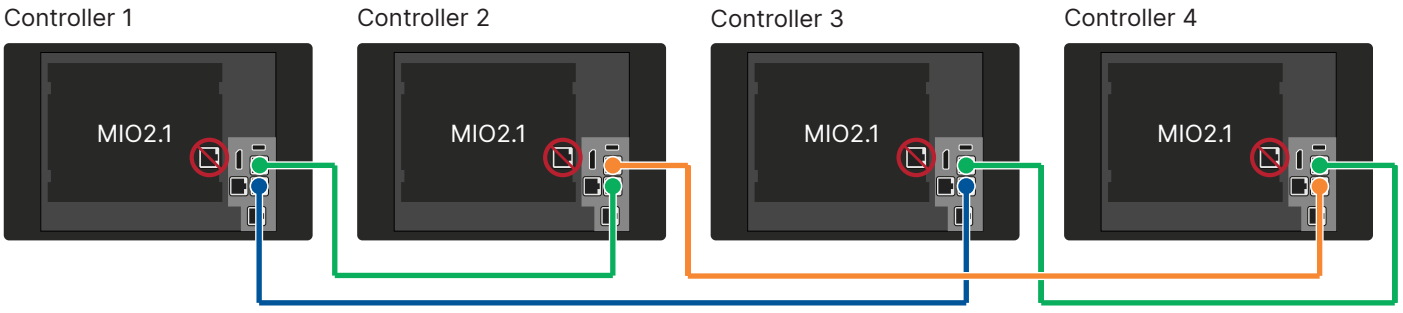
Network ring



Interleaving

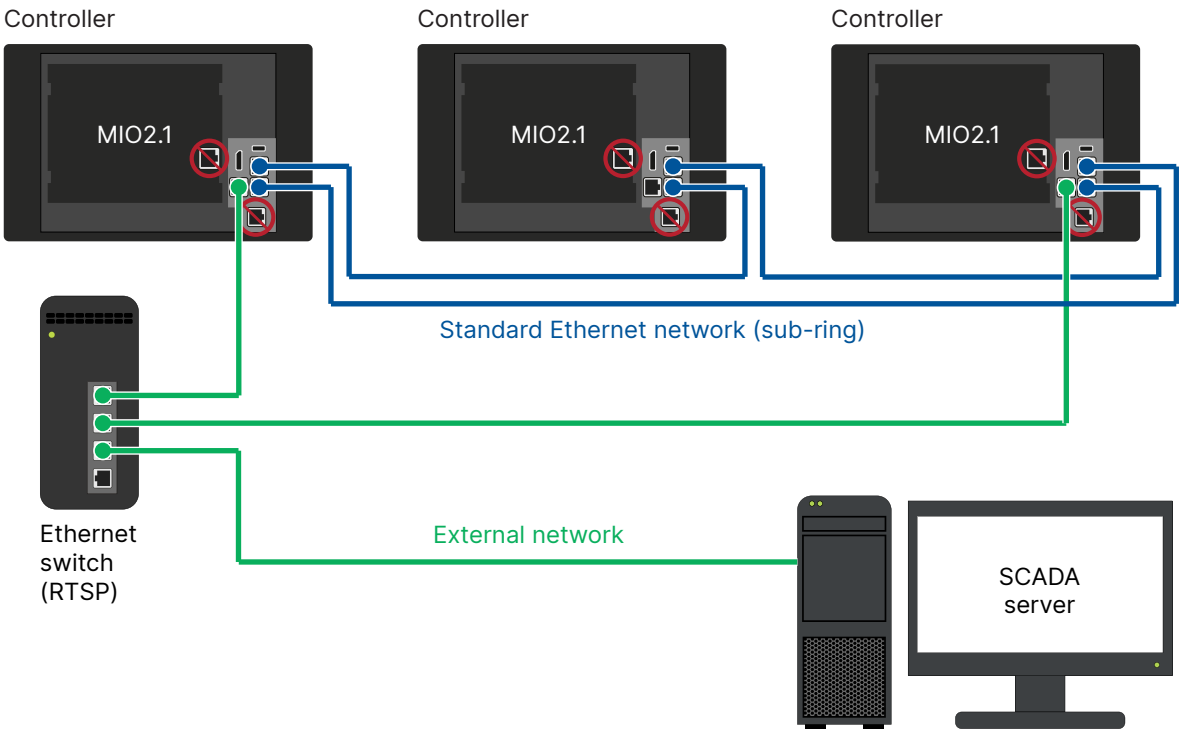
To avoid a long return connection for a long row of controllers, you can interleave the controller connections.

1. Connect each controller to the controller one step away, that is, connect 1 and 3 (blue), 2 and 4 (orange).
   - Make sure the cable paths are separated to minimise the risk of damaging two cables at the same time.
2. Connect the first two controllers to each other (green).
3. Connect the last two controllers to each other (green).



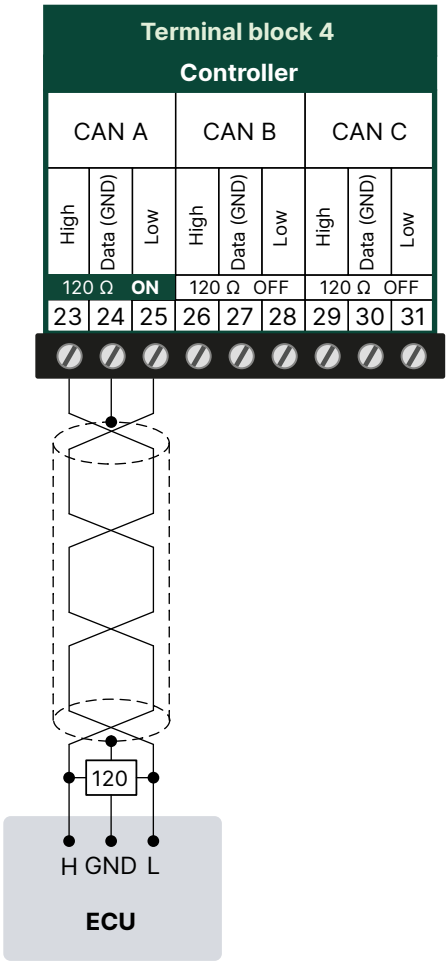
Redundant connection to SCADA or AMS

The network ring can be connected to a SCADA server, or an alarm monitoring system (AMS), with a redundant connection to two different controllers. This requires a switch that supports and has enabled Rapid Spanning Tree Protocol (RSTP). The controllers do not take an active part in RSTP, and additional re-configuration time may be expected.



4.5.6 CAN bus ECU or DAVR communication

ECU only

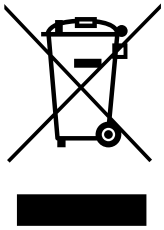


Communication to the ECU is using generic J1939 over CAN bus.

5. End-of-life

5.1 Disposal of waste electrical and electronic equipment

WEEE symbol



All products that are marked with the crossed-out wheeled bin (the WEEE symbol) are electrical and electronic equipment (EEE). EEE contains materials, components and substances that can be dangerous and harmful to people's health and to the environment. Waste electrical and electronic equipment (WEEE) must therefore be disposed of properly. In the EU, the disposal of WEEE is governed by the WEEE directive issued by the European Parliament. DEIF complies with this directive.

You must not dispose of WEEE as unsorted municipal waste. Instead, WEEE must be collected separately, to minimise the load on the environment, and to improve the opportunities to recycle, reuse and/or recover the WEEE. In the EU, local governments are responsible for facilities to receive WEEE. If you need more information on how to dispose of DEIF WEEE, please contact DEIF.